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A Comparison of the US and Soviet Economies: Evaluating the Performance of the Soviet System

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This paper was prepared by [] Office of
Soviet Analysis, with contributions and assistance
from []

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Comments and queries are welcome and may be
addressed to the Chief, Defense and Economic
Assessments Division, SOVA, []

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Preface

In October 1961 Nikita Khrushchev boasted at the 22nd Party Congress that by 1981 the Soviet Union would have a higher standard of living than any capitalist country. He also predicted that the USSR's industrial output would be twice the 1961 level of the entire nonsocialist world. These goals were reflected in the Party Program ratified by that Congress. Soviet economic performance at the time was robust, and the prospect of catching up with the United States did not seem unattainable. [REDACTED]

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In February 1986 Mikhail Gorbachev will preside over the 27th Party Congress. A new Party Program will be ratified that will outline a program to revitalize an ailing economy that still trails far behind that of the United States. [REDACTED]

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This comparison of the US and Soviet economies presents briefly the information we consider most important to an understanding of what has happened in the interval between the two Party Programs. [REDACTED]

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[REDACTED]
[REDACTED] For easy use, it is organized in questions and answers and makes liberal use of graphics. [REDACTED]

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The main sources of data are:

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CPAS 85-10001 [REDACTED] September 1985, *Handbook of Economic Statistics: 1985*.

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US Bureau of the Census, *Statistical Abstract of the United States: 1985* (105th edition), Washington, DC, 1984.

USSR Central Statistical Administration, *Narodnoye khozyaystvo* (annual editions).

Joint Economic Committee of Congress, *Soviet Economy in the 1980s: Problems and Prospects*, (parts 1 and 2), Washington, DC, 1982.

Other publications that were drawn upon and may be of interest to the reader are cited at the end of each section. [REDACTED]

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**A Comparison of the
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Key Judgments

*Information available
as of 1 August 1985
was used in this report*

General Secretary Gorbachev reportedly wants to make good on Khrushchev's boast that the USSR would surpass the United States economically and industrially. Moreover, recent articles by Gorbachev's economic adviser, Abel Aganbegyan, have highlighted the large gap between Soviet and US levels of output and productivity and have called for high growth—through the introduction of new technology and improved economic management—as the necessary policy response.

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The Soviets' use of the US economy as the standard against which to measure their own progress is longstanding. In fact, comparisons of Soviet economic performance with that of the United States are given a prominent place in the USSR's major statistical compendium. This preoccupation with comparisons stems in part from being number two and having to try harder and in part from the ideological need to demonstrate the superiority of the Communist system.

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But the Soviets' own statistics show that they have made no progress in overtaking the US economy since the mid-1970s. More detailed comparisons based on Western measures (presented in this report) give a picture that is generally similar, with the USSR falling somewhat further behind in some areas.

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The areas in which recent Soviet performance has been poorest relative to US performance since the mid-1970s are GNP size and growth, per capita consumption, quality of consumer goods and services, agriculture, development and application of new production technologies, and labor productivity:

- The Soviet economy on average grew faster than the US economy from the mid-1960s to the mid-1970s, raising Soviet GNP from 49 to 57 percent of US GNP. After 1975, however, the US economy grew faster, and Soviet GNP fell to 52 percent of the US level in 1984.
- The USSR's consumption level is like that of a country with a much lower per capita GNP. The costs of its defense activities for many years have exceeded US levels—often substantially—and its investment levels nearly match US levels, but its per capita consumption expenditures are only about one-third those in the United States.

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- The poor quality of many Soviet consumer goods and services is a persistent torment of daily life:
 - *Health care* is notoriously bad: insufficient funding, lack of qualified personnel, and shortages of supplies have helped to lower Soviet life expectancies.
 - *Housing* is shoddily constructed and poorly maintained, and about 20 percent of the urban population either lives in dormitories or shares living space with unrelated families and singles. In addition, most newlyweds are forced to live with their families because the waiting period for a new apartment may be as long as a decade.
 - *Soviet consumer goods* are usually of lower quality than Western models. The lack of quality control and the unpopular mix of available items are significant sources of consumer dissatisfaction, which contributes to low labor productivity. In the United States, items incorporating recent technological advances—digital watches, calculators, and video recorders—are widely available at low cost, but these are not generally available in the USSR. Soviet domestic production of many of these items started several years after commercial production began in the United States.
 - The Soviet *diet* contains more starchy staples than the American, and a larger proportion of Soviet daily protein intake comes from nonmeat sources. Shortcomings in processing and distribution often limit the variety of foods, especially fresh fruits and vegetables out of season.
- The USSR has an agricultural labor force eight and a half times as large as that of the United States, and it has 40 percent more land under cultivation and pasture. Yet agricultural production in the late 1970s and early 1980s failed to match the rapid growth in the Soviet demand for food. Shortages of quality foods like meat and dairy products have become chronic in some areas and are worsening.
- Some elements of the USSR's industrial and defense sectors are among the most advanced in the world, yet Soviet production technology has lagged behind technology in the West, and both productivity and product quality have suffered. With continued rapid Western advances, the Soviet lag in critical production technologies is likely to continue and may indeed grow.

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- The best Soviet *computer-operated machine tools* lag about three to four years behind Western models. We estimate that the United States currently has 550 cells (combinations of one or more numerically controlled machine tools with pallets and robots for materials handling, assembly, and checkout) in operation, while the USSR has 50.
 - The growth of the *robotics* industry in the USSR is inhibited by shortages of key electronic components and hardware and by quality problems. Many industrial facilities are too antiquated and improperly staffed to assimilate robots. Thus, the USSR lags considerably behind the West both in the production of advanced robots and in their integration into computer-integrated manufacturing.
 - Progress in Soviet domestic production (coupled with imported foreign technology) cut the West's lead in *microelectronics* technology from eight to 10 years in the mid-1970s to approximately four to six years in 1985. Deficiencies in Soviet production technology, however, are holding back advances in circuit complexity.
 - Although the Soviets now have modern unified *computer* systems, their progress in computer technology and production has been dwarfed by advances in the West and Japan. The Soviets lag behind the West by an estimated seven to eight years in mainframe technology and four to six years in the development of minicomputers and microcomputers. Only 8 percent of all Soviet industrial facilities had mainframe computers in 1984, including one-third of the facilities with over 500 employees. By comparison, virtually all US industrial facilities with more than 100 employees have computers. In addition to this shortage of equipment, computer applications have been constrained by slow software development and severe shortages of programmers and repair technicians.
 - Overall and in detail, Soviet labor is less productive than US labor; Soviet GNP per worker is only 38 percent of the US level.
- Soviet performance in other areas is brighter:
- In terms of overall nutrition, the diet now nearly matches that of the United States. Although Soviet citizens on the average still eat only half as much meat as US citizens do, their per capita consumption of meat has increased by 40 percent since 1970.

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- While US manufactured goods are frequently of higher quality than Soviet goods, the USSR is the world's leading producer of several basic raw industrial products, such as pig iron, crude and rolled steel, certain types of machine tools, electric generators, and cement.
- The USSR produced more energy in 1984 than any other country except the United States, and was the world's largest producer of crude oil and natural gas.
- Soviet per capita expenditures for consumer durables are less than 20 percent of the US level—but they have nearly doubled since 1960. Almost every US family has a refrigerator and at least one TV set; two-thirds of all Soviet families have refrigerators and three-fourths have TV sets.

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Despite some progress, the Soviet system has become less attractive as a model for development. Several Communist countries, particularly China, have in some sectors moved from centralized planning toward free markets, suggesting that the influence of the Soviet system has already weakened. The limited and largely experimental reforms of the Brezhnev, Andropov, and Chernenko years did nothing to correct the basic systemic distortions that ultimately prevent Soviet planners, managers, and consumers from making economically efficient decisions. Three fundamental flaws are (1) the lack of reliable price signals to guide economic decisions; (2) the limited influence that consumers have on producers; and (3) the absence of real competition among suppliers.

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Comparisons between the US and Soviet economies are hampered by several difficulties, many of which are common to all cross-national comparisons. Most of the conceptual problems arise from the differences in the structure and maturity of the two economies. A greater variety and higher quality of goods generally are produced in the United States than in the USSR, and these goods are produced in different proportions in each country, with the proportions themselves varying from year to year. In the area of data availability, Soviet data have been criticized on a number of grounds, including their selectivity, the choice of weighting systems that present achievements in the best possible light, and—occasionally—outright falsification. These problems and others are elaborated on in appendixes A and B.

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These problems notwithstanding, US-Soviet economic comparisons are useful because (1) they illustrate the performance of the Soviet economy in terms familiar to US policymakers (that is, US economic concepts) and (2) they measure Soviet economic progress against a standard that the Soviets themselves have chosen—the US economy. More important, in a world of competing national interests and ideologies, such comparisons provide a perspective on the relative economic strength of the two countries.

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Comparisons of Gross National Products

The development of the Soviet economy relative to that of the United States since Khrushchev's day may be traced through a comparison of trends in aggregate GNP and in the major categories of GNP (consumption, investment, and defense). In this first section we set the stage for the other comparisons in the paper by posing the questions:

- *How big is the Soviet economy?*
- *How fast has the Soviet economy grown?*
- *How does the distribution of output by end use differ in the USSR and the United States?*

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How Big Is the Soviet Economy?

GNP

The gap between the Soviet and US economies narrowed between 1960 and 1975, as Soviet GNP rose from 49 to 57 percent of the US total.¹ The USSR lost ground after that, however, as its GNP fell to 52 percent of US GNP by 1984 (figure 1). Viewed in another way, Soviet GNP in 1984 was about as large as US GNP was 20 years earlier. [redacted]

Although the Soviet Union gained some ground over the past two decades, the size of the absolute difference in annual production increased, whether measured in rubles or dollars (figures 2 and 3). In years of recession in the United States (for example 1970, 1974-75, 1980, and 1982) the gap was narrowed, but overall it widened noticeably after 1976. Between 1960 and 1984, US GNP grew more than Soviet GNP by \$450 billion or 385 billion rubles. [redacted]

Defense²

US defense spending declined in real terms during 1969-76 as the United States disengaged from the Vietnam conflict. During approximately the same period, consistent growth pushed total Soviet defense costs to a peak about 40 percent higher than those of the United States (figure 4). The annual rate of Soviet defense growth slowed after 1976. With the acceleration in US defense spending, the gap has closed markedly, but the cumulative costs of Soviet defense activities between 1976 and 1983 still exceeded those of comparable US activities by about 30 percent. [redacted]

As a result of these trends, the Soviet Union committed substantially more resources to defense activities than did the United States over the last decade. The

¹ To compare two economies, each country's goods and services are priced in the other's currency. The "average" is obtained by calculating the geometric mean of the comparisons in dollars and rubles (see appendix A). See also appendix B for a discussion of how quality differences between US and Soviet goods and services are handled. [redacted]

Soviets procured more weapons of almost every type, operated larger forces, and pursued a greater research and development effort. [redacted]

Investment

Total Soviet investment in buildings, structures, machinery and equipment, and selected aspects of capital repair grew almost twice as fast as that of the United States during 1960-83; it averaged 5.5 percent annually, while that of the United States averaged 3 percent. Soviet investment stayed at about three-fifths of the US level through the mid-1960s, rose to three-quarters by the early 1970s, and slightly exceeded US investment in 1975, 1976, 1982, and 1983. [redacted]

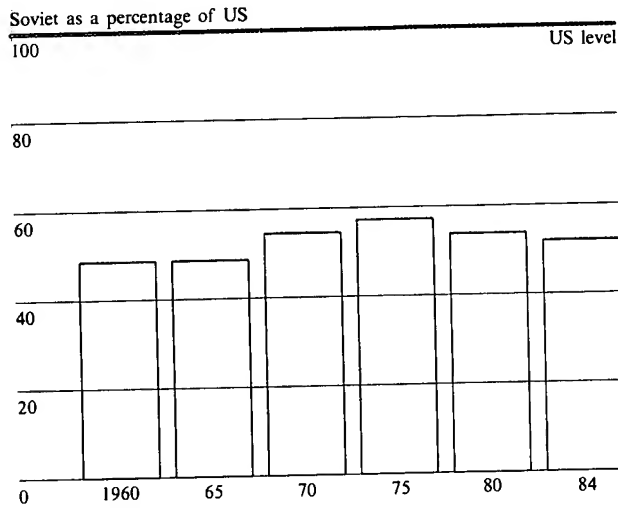
Consumption

The Soviets have gained slightly in total consumption since 1960. Their consumption over the period rose from 37 percent of the US level in 1960 to 41 percent in 1983.³ [redacted]

³ Comparisons of per capita consumption—widely used as measures of standards of living—will be presented in the Living Standards section. The pattern of growth in per capita consumption is essentially the same as in total consumption because the two populations have grown at roughly the same rate since 1960. Soviet per capita GNP in 1983 was 35 percent of the US level. [redacted]

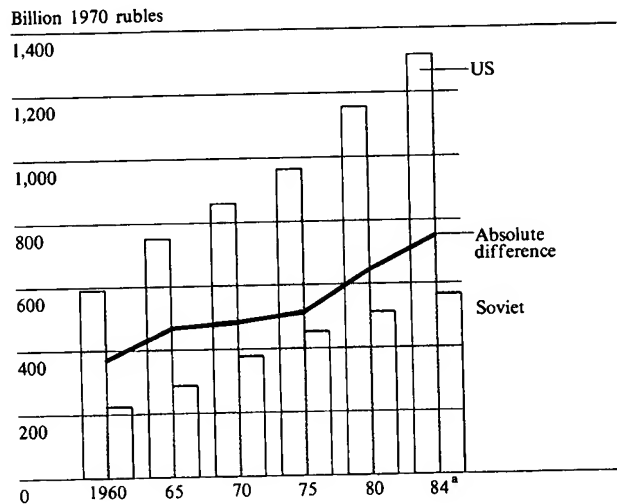
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Figure 1
Gross National Product (GNP),
Selected Years



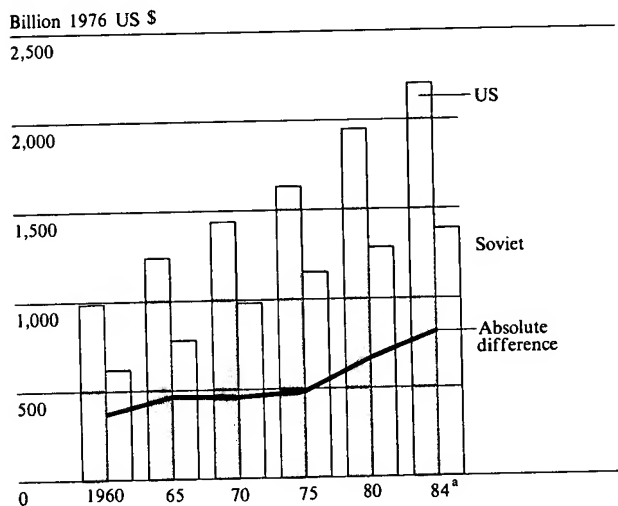
Note: The Soviet level is the geometric mean of the dollar and ruble comparisons (see appendix A).

Figure 2
Ruble Difference Between US
and Soviet GNPs, 1960-84



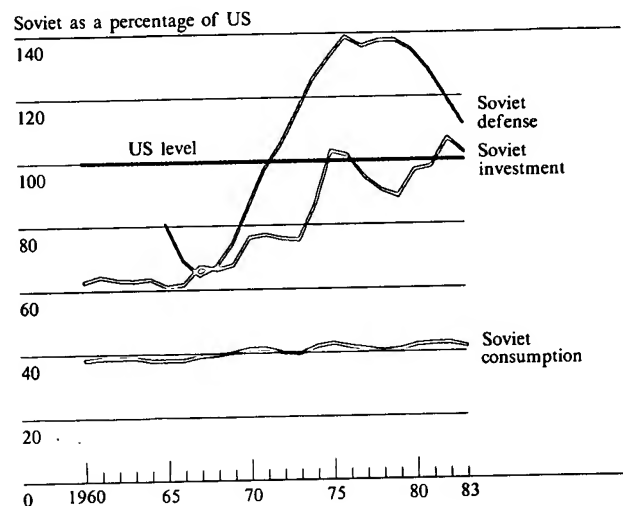
^a Preliminary.

Figure 3
Dollar Difference Between US
and Soviet GNPs, 1960-84



^a Preliminary.

Figure 4
Components of GNP, 1960-83



Note: The Soviet level is the geometric mean of the dollar and ruble comparisons (see appendix A). The defense comparison begins in 1965 because we are less confident in our estimates for 1960-64.

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How Fast Has the Soviet Economy Grown?

Official Soviet Statistics Compared With Western Estimates

Both the official Soviet statistics on national income and the various Western estimates of Soviet GNP have shown a slowdown in economic growth in the USSR since the mid-1960s, even though the measures are different. (The Soviets use a Marxist concept of national income—net material product—that excludes most of the value of services and depreciation.)

[REDACTED]

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Soviet GNP Growth Compared With US GNP Growth

Through the 1960s and up to the mid-1970s, Soviet real growth rates were higher, on average, than US rates (figure 5). The pattern shifted in favor of the United States between 1976 and 1984, when Soviet average GNP growth was less than that of the United States. [REDACTED]

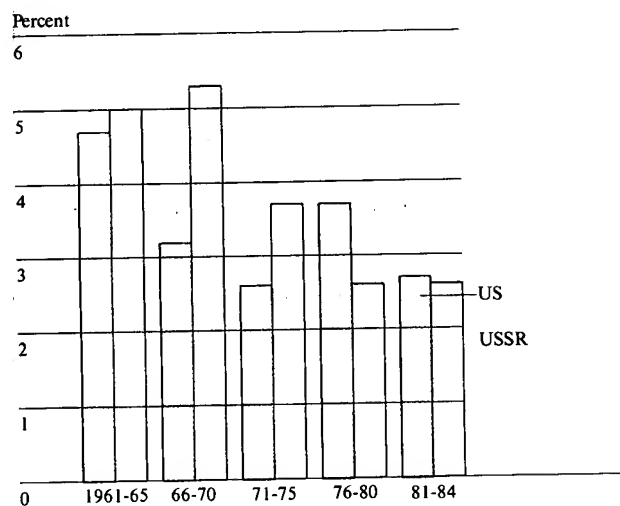
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Short-term variations in the relative size of US and Soviet GNP have had various causes. Ups and downs in the United States have generally reflected business cycles. The major cause of annual swings in Soviet GNP, on the other hand, has been variation in agricultural output—agriculture being influenced by weather in spite of planning. (Planning tends to promote economic stability by controlling fluctuations in demand—although plan goals may not be met, for a variety of reasons.) As a rule, though, Soviet GNP has been less volatile than US GNP. [REDACTED]

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Figure 5
Average Annual Growth of
GNP, 1961-84



Note: Both GNPs are measured in own prices. The base years for these periods are 1960, 1965, 1970, 1975, and 1980.

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How Does the Distribution of Output by End Use Differ in the USSR and the United States?

Defense

Changes in shares of defense spending in GNP have produced the greatest changes in the distribution of GNP in the two economies in the last two decades. After the Vietnam war the United States halved the share of GNP going to defense—from 10 percent in the late 1960s to 5 percent by the mid-1970s (figure 6). Then US defense spending increased in the early 1980s, pushing the defense share of GNP to 6 percent in 1983. The Soviets, on the other hand, allocated to defense a fairly steady share of GNP—between 12 and 13 percent—over the whole 1965-83 period. These burden estimates are based on a US definition of defense that includes the following US activities (and their Soviet counterparts): national security programs funded by the Department of Defense, defense-related nuclear programs funded by the Department of Energy, Selective Service activities, and the defense-related activities of the Coast Guard. It does not include those activities that might be considered to be related to a broader concept of national security, such as strategic reserves, industrial surge capacity, civil defense, and military aid. Inclusion of such activities in a definition of defense would result in a higher burden for both countries.

Investment

Since 1960 the USSR has devoted a greater share of its economic resources to investment than has the United States (figure 7). In the USSR, investment climbed steadily from 20 percent of GNP in the early 1960s to 28 percent by 1983, while in the United States it fluctuated between 17 and 20 percent. Soviet investment in machinery and equipment increased from 4 to 12 percent of GNP, while investment in construction remained fairly steady around 15 to 16 percent of GNP. In the United States, investment in machinery increased from 5 to 9 percent of GNP, while construction's share steadily decreased from 13 to 9 percent.

Consumption

Consumption accounts for a much larger portion of GNP in the United States than it does in the Soviet Union—71 and 57 percent, respectively, in 1983. Within the consumption category, the US economy has increasingly shifted toward the provision of services, while the Soviet economy has not. The Soviet service sector remained at a relatively steady 12 percent of GNP over the last two decades, while the US service sector increased from 34 to 39 percent of GNP by 1983. In both countries, the share of GNP devoted to durables increased while the share devoted to soft goods remained about the same. As incomes rose, the share going to food decreased, as would be expected.

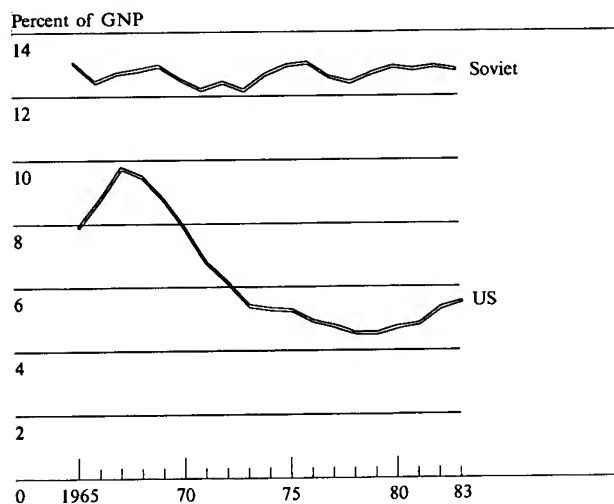
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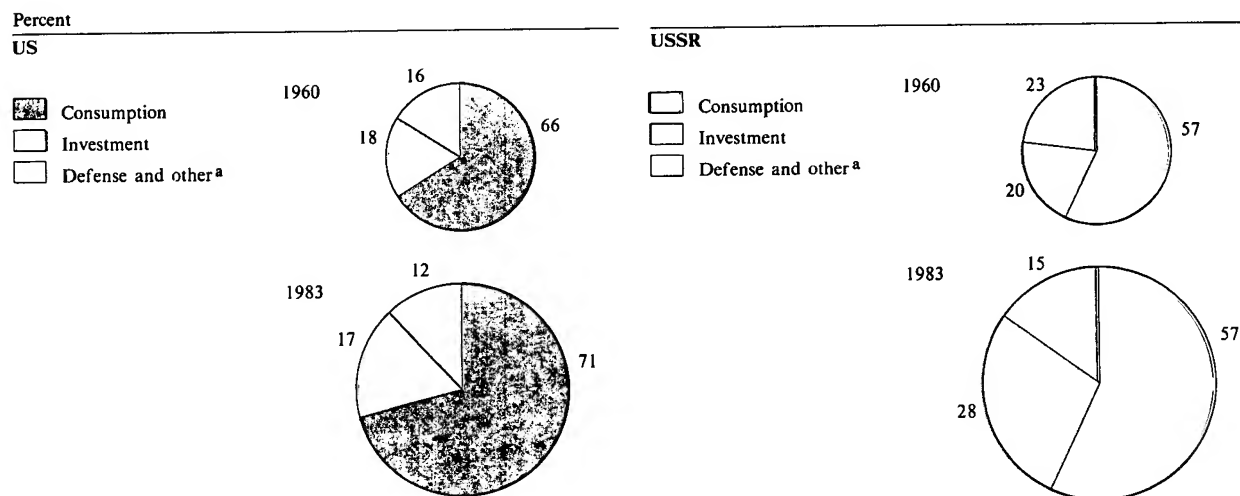
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Figure 6
Defense Burdens, 1965-83



Note: US data are in 1976 dollars; Soviet data are in 1970 rubles.

Figure 7
Consumption and Investment as Shares of GNP, 1960 and 1983



^a "Other" includes administration (bodies providing municipal, state, and federal government services), net exports, inventory change, foreign military assistance, and any statistical discrepancy.

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Rapid expansion of the industrial sector has long been a priority goal in the USSR, because Soviet economic doctrine holds that industry is the base from which economic development springs. In this connection, the Soviets have frequently used the industrial output of the United States as a benchmark of their progress. For example, Khrushchev predicted in 1959 that Soviet industry would outproduce US industry by 1970. In 1982, by Soviet calculations,⁴ Soviet industrial output reached 80 percent of US output—a remarkable achievement, but still short of Khrushchev's mark. Soviet industrial growth, moreover, slowed unusually sharply after 1975. This section addresses the questions:

- *How does Soviet industrial performance compare with that of the United States?*
- *Why did Soviet industrial production fare badly in the late 1970s?*
- *How well do the United States and the USSR develop and apply technology?*

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⁴ Comparisons of GNP by sector of origin (for example, industry or agriculture) are not generally made in the West. This is because such comparisons would require price deflators and an array of ruble-dollar ratios for intermediate products that are not now available or likely to become available, given the Soviet policy of not releasing the necessary information.

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How Does Soviet Industrial Performance Compare With That of the United States?

Rates of growth of industrial production have been higher in the USSR than in the United States through most of the postwar period (figure 8 shows the recent years). The sector that produces goods for other industries has received particular emphasis. The Soviet Union now outproduces the United States in such basic products as crude and rolled steel, pig iron, and cement (figures 9, 10, and 11). While it lags far behind in several categories of modern technology, such as electronics and computers, it has become the world leader in many other industrial areas (table 1).

Limited variety and poor quality control detract from the otherwise impressive Soviet industrial performance. Low-quality metallurgy and fabrication are a continuing problem. For example, the poor quality of Soviet-produced drilling and pumping equipment and large-diameter pipe has hampered Soviet production of oil and gas and increased the petroleum industry's demand for better equipment imported from the West. In 1984 the USSR produced over five times as many metal-cutting machine tools as the United States, but most of them were of less sophisticated types. The inferior durability, reliability, and workmanship of Soviet consumer goods is widely acknowledged.

Table 1
Selected Lines of Production in Which the US
and the USSR Lead the World, 1984

Physical volume of output

Minerals and Metals		Manufactured Goods		Chemicals	
USSR	US	USSR	US	USSR	US
Refined copper	Primary aluminum	Woven woolen fabrics	Plastics	Synthetic ammonia	Caustic soda
Pig iron	Primary magnesium	Woven rayon and acetate fabrics ^a	Synthetic rubber	Mineral fertilizer	Sulfuric acid
Crude steel	Molybdenum	Electric generators ^b	Synthetic fibers	Nitrogen fertilizer	Phosphate fertilizer
Rolled steel		Turbines ^b	TV receivers ^b	Potassium fertilizer	
Refined nickel		Metal-cutting machine tools	Rubber tires		
Smelted lead		Metal-forming machine tools	Plywood		
Refined zinc			Passenger automobiles		
Titanium sponge		Grain combines ^b			
Platinum		Tractors			
Chromite		Railroad freight cars			
Tungsten ore		Cement			
Iron ore					
Manganese ore					

^a 1982 figure.

^b 1983 figure.

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Figure 8
Index of Industrial Production,
Selected Years, 1965-84

Index: 1970 = 100

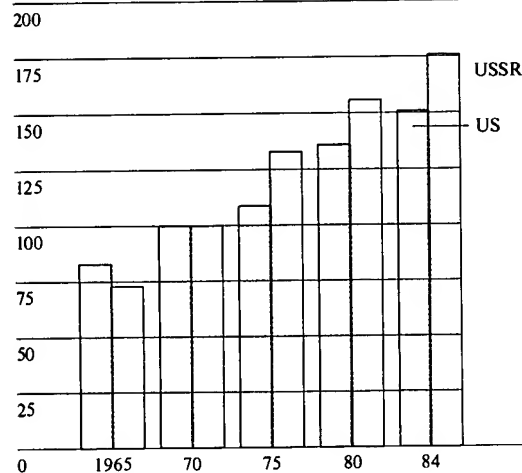


Figure 9
Production of Minerals and
Metals, 1984

Soviet as a percentage of US

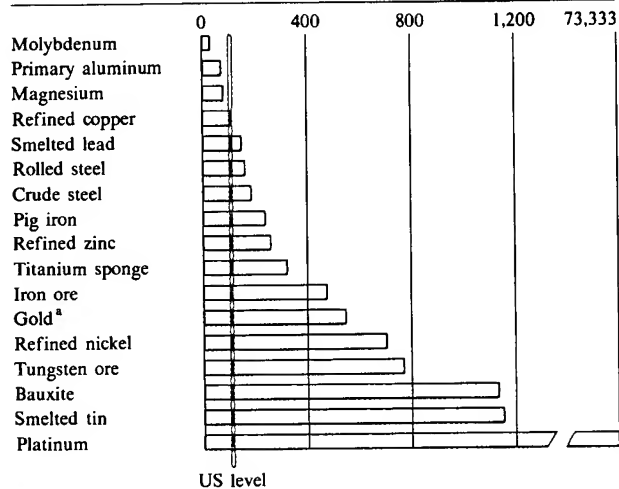
^a1983 figure.

Figure 10
Production of Chemicals and
Rubber, 1984

Soviet as a percentage of US

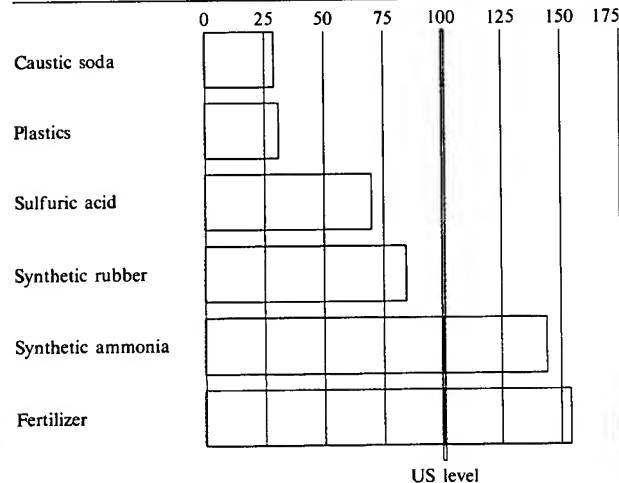
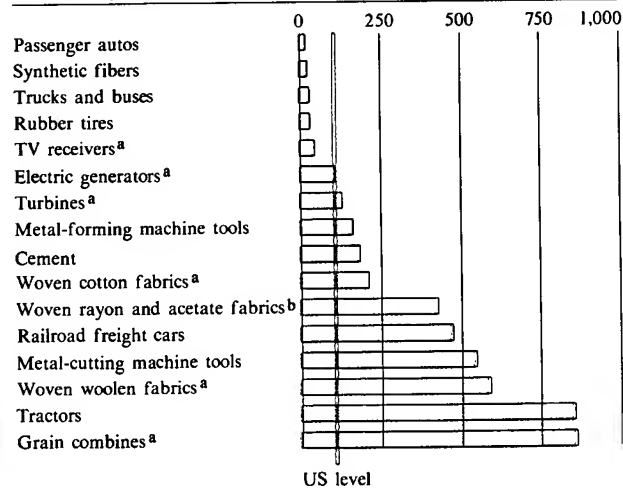


Figure 11
Production of Selected Manufactured
Goods, 1984

Soviet as a percentage of US

^a1983 figure.^b1982 figure.

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Why Did Soviet Industrial Production Fare Badly in the Late 1970s?

In every five-year plan since 1950, Soviet industrial output has grown more slowly than in the preceding plan period. The 1976-80 plan called for an average annual rate of output only about half as great as that in the previous period. The actual rate in 1981-84 was even lower—3.1 percent:

	Percent
	Average Annual Growth of Industrial Output
1951-55	10.1
1956-60	8.4
1961-65	6.7
1966-70	6.4
1971-75	5.9
1976-80	3.2
1981-84	3.1

A decision made in 1975 and implemented in 1976 radically altered Soviet economic growth strategy. Until 1975 the leaders achieved increased production mainly by "extensive" means—feeding industry large increments of plant, equipment, and labor. But labor reserves were diminishing, and the amount of new fixed capital required to provide a ruble's worth of additional production began to climb steeply in the early 1970s. The Soviets decided to put some teeth in their much-talked-of program to achieve economic growth by increasing productivity. They apparently decided to try reducing the targets for production growth so that efficiency could be improved, expecting the greater efficiency to lay the foundation for future growth. They implemented this decision by cutting the planned rate of growth of new fixed investment to one-half of the 1975 level.

The strategy failed—the combined productivity of labor and capital in industry fell sharply in 1976-80. The plan had set unrealistic goals for the production of industrial materials and energy, and, when these basic sectors faltered in the late 1970s and failed to meet their requirements, they created bottlenecks in production elsewhere. Disruptions caused by rail transport problems exacerbated the shortage problems and helped reduce growth in industrial output.

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How Well Do the United States and the USSR Develop and Apply Technology?

Technological Lag

Soviet production technology generally has lagged behind technology in the West, and both productivity and product quality have suffered. Soviet commercial goods have rarely been competitive in Western markets, where even below-market pricing has not overcome the disadvantages of poor quality. Table 2 illustrates the Soviet lag behind the United States in areas of technology that are important to the performance of defense and defense-supporting industries; the six highlighted areas are also of particular importance to long-term industrial development and economic performance. []

Defense industries (particularly those in the more technically stressing sectors—aircraft, missile, space, and shipbuilding) traditionally have compensated for their technological shortcomings by designing weapon systems that emphasize simplicity and ease of manufacture in labor-intensive factories. They have generally offset the weapons' inferiority in one-for-one performance comparisons with Western weapons by larger production runs and inventories. []

Beginning in the mid-1970s, however, Soviet industry has increased its emphasis on more complex and competitive weapons, aided by an aggressive program to acquire and exploit Western technologies for military and for dual (military and civilian) use. This has narrowed the gap in some important technologies, but it has not led to dynamic and innovative technology development in Soviet support industries. With continued rapid Western advances, the Soviet lag in critical production technologies is likely to continue and may indeed grow. []

Computers and microelectronics are of critical importance to advances in productivity and product quality, both in the end products and in more capable production equipment (such as numerically controlled machine tools, flexible manufacturing systems, and computer-aided design and manufacturing equipment). These have their most substantial impact when they are combined in computer-integrated manufacturing (CIM) systems, which centralize control of plant production. In their most advanced variants, CIM

systems integrate computer-based management and design systems with computerized machining, robotics, automated inspection, automated material handling and warehousing, and automated stock control and planning. In the West they are being widely applied in automotive, machine tool, electronics, computer, and weapons production. They have led to substantial economies in labor and inventory costs, while enabling manufacturers to respond quickly and economically to changing demands. []

The interdependence of these technologies spurs advances in related fields. Progress in microelectronics, for example, feeds advances in the entire range of advanced machine tools, robotics, industrial process control systems, telecommunications systems, and computers. Telecommunications and computer hardware or software advances expand the application of automated manufacturing either by pushing the state of the art (through robotic vision systems and pattern recognition, for example) or by reducing cost. Advances in machining, robotic assembly and inspection, and computers in turn fuel new rounds of improvement in electronic components and systems. This kind of feedback and interaction underpins the dynamic growth of these industries in the West and Japan but is not generally characteristic of Soviet development. []

In a June 1985 speech, General Secretary Gorbachev singled out advanced technologies as having a "revolutionary" role in transforming the Soviet economy. His initiative accelerates the major Soviet technology development programs begun in the mid-1960s and responds to the manufacturing revolution well under way in the West. By Western assessment, the USSR has kept pace with the rate of Western technological advance, though it lags considerably in such key areas as microelectronics and computers (table 3). The Soviets' own assessments confirm this; they know they have made great strides, particularly in microelectronics—in which they have moved (often using Western technology) from almost total dependence on Western sources for both circuit design and production equipment to a position from which they can go forward using indigenous resources. Whether the

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Table 2
US and USSR: Relative Standing
in the 20 Most Important
Basic Technology Areas

	The United States Is Superior	The United States and the USSR Are Equal	The USSR Is Superior		The United States Is Superior	The United States and the USSR Are Equal	The USSR Is Superior
Aerodynamics and fluid dynamics		X		Nuclear warheads		X	
Computers and software	<X			Optics	X>		
Conventional warheads (including all chemical explosives)		X		Power sources, mobile (including energy storage)		X	
Directed energy (lasers)		X		Production and manufacturing (including automated control)	X		
Electro-optical sensors (including infrared)	X			Propulsion (aerospace and ground vehicles)	X>		
Guidance and navigation	X>			Radar sensors	X>		
Life sciences (human factors and biotechnology)	X			Robotics and machine intelligence	X		
Materials (light-weight, high strength, high temperature)	X>			Signal processing	X		
Microelectronic materials and integrated circuit manufacturing	X			Signature reduction ("Stealth" aircraft)	X		
				Submarine detection	X>		
				Telecommunications (includes fiber optics)	X		

Notes: These 20 technologies provide a range for comparing overall US and Soviet basic technology. The list is in alphabetical order. These technologies are "on the shelf" and available for application. (The list is not intended to compare technology levels in currently deployed military systems.)

The technologies shown have the potential for significantly *changing* the military capability in the next 10 to 20 years. They are not static; they are improving or have the potential for significant improvements. An arrow indicates that the relative technology level is changing significantly in the direction indicated. The six highlighted areas are also of particular importance to long-term industrial development and economic performance.

Source: The FY 1986 Department of Defense Program for Research, Development, and Acquisition, Statement by the Under Secretary of Defense, Research and Engineering, to the 99th Congress, First Session, 1985, P. II 4.



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Table 3
USSR: Lag in Advanced Technologies

Technology Area	Years Behind the United States
Computer-operated machine tools	3 to 4
Microprocessors	4 to 6
Memories (dynamic random-access memory circuits)	3 to 5
Minicomputers	4 to 6
Flexible manufacturing systems	5 to 6
Mainframe computers	6 to 8
Large scientific computers	more than 8
Magnetic disk units	8 to 10

USSR can extend these successes in basic technologies so as to reap the benefits of their application in manufacturing, however, will depend in large measure on the ability of Soviet industry to overcome its systemic problems. In the meantime, accelerating Western progress in both support industries and applications will make it difficult for the Soviets to prevent the lag from widening in both productivity and the quality of industrial products. []

Factors Inhibiting Soviet Advance in Civil and Support Technologies

Slow technological advance in Soviet civil industry is attributable to a number of factors that affect all phases of the research-design-production process:

- Military priority status. The Soviet leadership continues to favor the military with generous funding and priority access to resources and foreign technology, despite serious problems in the civilian economy. Military research and development (R&D) now account for a significant portion of the USSR's total R&D spending and manpower. Spillovers from military R&D to civilian industry, moreover, have been less important than in the United States.
- Inefficient research and a lack of effective coordinating mechanisms between science and civil industry. In the absence of such mechanisms, Soviet science has been biased toward theoretical work,

with little push for industrial applications; for example, there is no parallel in the USSR to the Western phenomenon of commercial spinoffs from academic biotechnology research. Military industry also has difficulty in enlisting academic R&D support, but its high-priority status allows Soviet planners to overcome this problem in most instances.

- Insulation of production sectors. Industry seeks to minimize production problems and has been reluctant to accept the risks inherent in the introduction of new technology. The bias of the production sector against the fruits of R&D reinforces the division of science and industry into two separate communities.
- Lack of incentives for technological innovation or increased productivity. The current system of bonus incentives makes innovation unrewarding. Plants receive performance awards not for *productivity* gains in comparison to similar plants but for *production* gains in comparison to their own past figures. Even a temporary failure to match past production is punished more severely than a failure to increase productivity.
- Lack of close working cooperation between designers of the product and planners of the production process. This is of increasing importance as computer-aided design and manufacturing systems allow major production economies and improved product quality through integration of product and process design. []

Technological Innovation Discouraged

Some of the strengths of the Soviet planning and management system hinder technological advance. Lacking the technological entrepreneurs who in Western market economies respond to new market opportunities without being directed, the Soviet system depends on its planners to have sufficient vision to anticipate future demands. Development by directive, however, tends to focus the planners' attention on the product and frequently neglects the needs of support industries, in both the military and civilian ministries.

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In high-priority programs, this has meant that technologies related to the product are developed faster than technologies related to materials and production processes. Lack of development in these basic areas constrains product design by impeding fulfillment of the manufacturing requirements that all designs must meet, and it causes delays and bottlenecks in production. This lack of integration between product and process designers plagues both civil and defense industries. []

Ironically, therefore, the greatest deficiency of the Soviet centrally planned industrial system is not that it plans too much but that it cannot plan enough. The staffs that supervise industrial planning and programming are quite small, considering the size and complexity of the resources to be planned. When planners give instructions for the development of production technology and industrial infrastructure, these are almost never as detailed as the instructions dealing with product characteristics and production schedules. []

To compensate for their inability to plan everything, the Soviets constantly check performance against various standard indicators—one of the simplest being the number of items produced on schedule—and they base incentive rewards for managers and workers on their enterprise's achievement of its assigned indicators. Such simplistic criteria have caused distortions and inefficiencies in Soviet industry, however, as managers focus on their indicators to the neglect of quality, investment, and the development and assimilation of new technology. []

Reform Measures

Recognizing these problems, Soviet leaders have been experimenting for as long as two decades with ways to improve performance in the R&D sector. In the last several years the Central Committee and the Council of Ministers have made a number of changes in the structure and management of R&D, including measures to stimulate innovations and their adoption in industry and the economy. The Soviets themselves note that these have not yet made a difference. []

A decree issued in 1985 may be more effective, however. By allowing plants to reduce their production quotas in compensation for time lost in retooling,

it may counteract the industrywide preoccupation with meeting current production schedules at the expense of industrial modernization. []

Technology Acquisition and Assimilation

Pressed by R&D resource constraints and driven by the need to compete in weapons quality with the rapidly advancing West, the Soviets will continue—and intensify—their effort to acquire and exploit Western technologies. This effort has been elevated to a national-level program, but it is not set up to deal with the inefficiencies inherent in the Soviet R&D system—which the Soviets must overcome if their economy is to become more productive. Acquired technologies face the same assimilation and diffusion problems as the Soviets' indigenously developed technologies, plus special handicaps that often arise from the acquisition process itself. If an item is COCOM restricted or illegally acquired, for example, the Soviet technicians will lack the Western manufacturer's usual documentation, maintenance, and support. Another special handicap is the delay in the handling and distribution of items whose origins must be disguised before transfer to end users. []

A particular difficulty is that piecemeal acquisition of automated production equipment often causes compatibility problems in an enterprise trying to set up a new production line. Product quality may be improved, as planned, but the delays and inefficiencies caused by such mismatches can eliminate the productivity gains that a Western plant would expect from automated production; they may even reduce productivity. []

Nevertheless, the program for technology acquisition will continue to provide benefits. It does introduce innovation, however haltingly; and it reduces R&D risk and eliminates false research starts by allowing Soviet industry to follow or copy proven Western designs and process approaches. This saves development time and costs and improves product quality, and it will satisfy to some extent the need to catch up or maintain technological parity with the West. []

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Confidential**Agriculture**

Agriculture is vitally important to the domestic economy of the USSR and is a way of life for 10 percent of the Soviet citizenry. In recent years, as the Soviet role in international commodity trade has expanded significantly, Soviet agriculture has also taken on much greater international political and economic importance. This section examines the following questions:

- *How do Soviet natural conditions and agricultural organizations compare with those in the United States?*
- *How does Soviet agricultural performance compare with that in the United States?*
- *Why did Soviet agricultural production slip in the 1970s?*

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How Do Soviet Natural Conditions and Agricultural Organizations Compare With Those in the United States?

Environmental Limitations

Agriculture in the USSR faces severe environmental limitations. Because most of the sown area is climatically comparable to the northern Great Plains areas in the United States and the Prairie Provinces of Canada (figure 12), the average productivity of land is lower in the USSR than in the United States as a whole. Even where soil and climate conditions are similar, crop yields are lower in the USSR. Moreover—mainly because of differences in the environment and cropping practices—the year-to-year variation in farm output is three times as great in the USSR as in the United States. []

Productive cropland in the USSR is squeezed between the cold north and the arid south. Farming is possible outside this agricultural zone, but it is risky and expensive. The growing season in most of the Soviet Union is short compared with that in most of the United States; late frosts and early snows are common in the major grain-growing areas, which lie at the same latitudes as the Prairie Provinces of Canada (figure 13). The southernmost part of the USSR—which lies at the same latitude as Tennessee—has a longer growing season, but much of it is semidesert and desert. []

Even though the surface area of the Soviet Union is more than twice as large as that of the United States, a much smaller share is suitable for agriculture: nearly one-half of US land is cultivated or under pasture and only about one-fourth of Soviet land (figure 14). In absolute terms, however, the USSR has 40 percent more land under cultivation or pasture. []

No Soviet region has the ideal mix of soil, moisture, and warmth that is found in the US cornbelt. About half the total area of each country has adequate moisture, but only 10 percent of the USSR has sufficient heat as well. About 30 percent of the USSR is too cold for any agriculture, and another 40 percent is so cold that only hardy early-maturing crops can be grown. In the United States, cold is a limiting factor in about 20 percent of the area. []

Agricultural Organizations

Even greater than the environmental differences are the institutional differences between US and Soviet agriculture. The collectivization of Soviet agriculture has created two sectors—socialized (consisting of state and collective farms), which accounts for three-fourths of the farm output, and private, which accounts for one-fourth. []

Private agriculture in the USSR is carried out on 40 million small plots of land (up to 1 acre), where households grow crops and usually keep a few head of cattle or pigs and a small flock of poultry. Most people with private plots have other jobs and produce food as a secondary occupation. Nevertheless, Soviet consumers rely either on their own plots or on direct purchases from private producers for a major share of their consumption of vegetables, meat, dairy products, and other perishable produce. []

In comparisons of farm organization and resource use in the United States and the USSR, the degree of managerial freedom is critical. Many commentators compare decisionmaking by collective and state farm managers to that by managers of very large corporate-type farms in the United States; but the evidence indicates that continual intervention by Soviet central officials and planners leaves very little decisionmaking latitude for individual Soviet farm managers. Collective and state farm managers, accustomed to almost daily administrative interference “from above,” would be bewildered at the depth and pattern of on-farm decisions made by US farmers and farm managers. []

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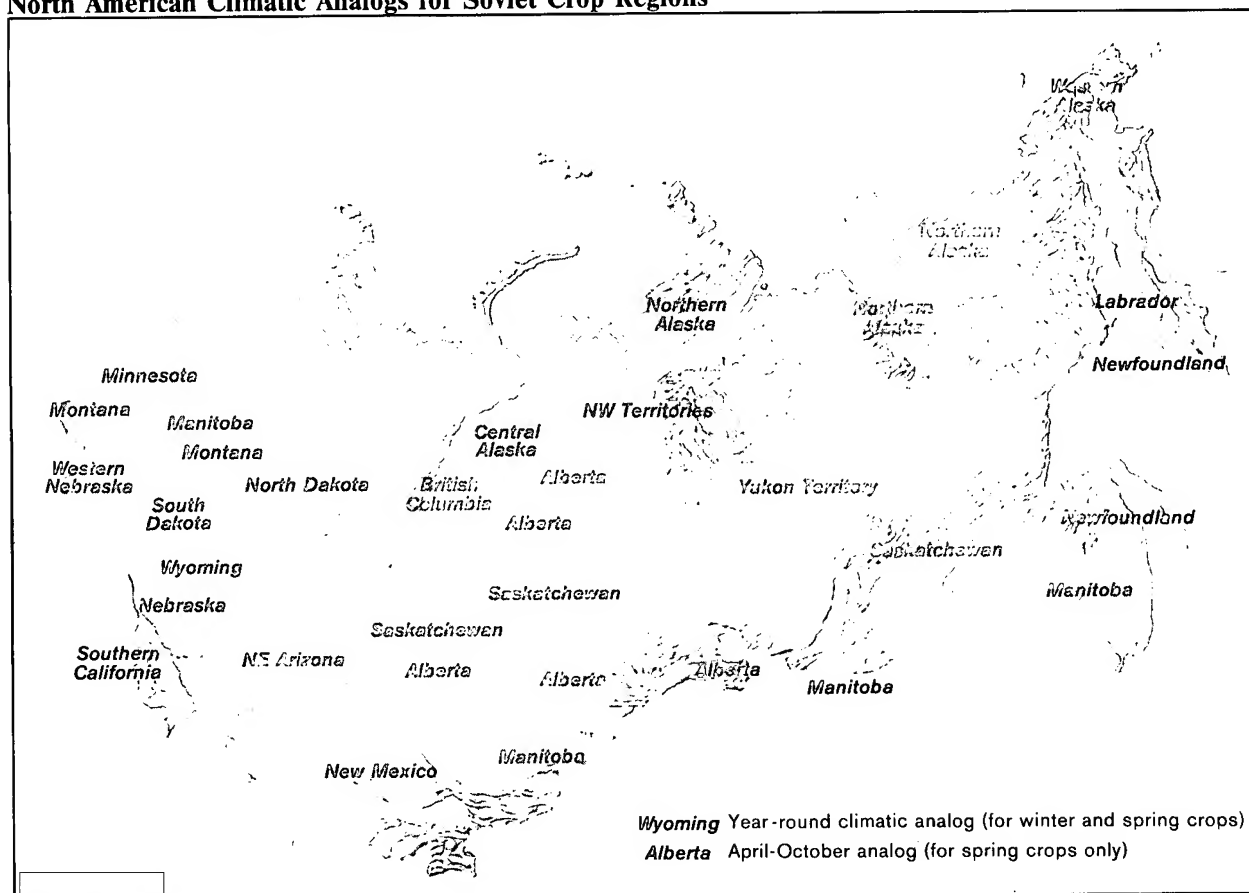
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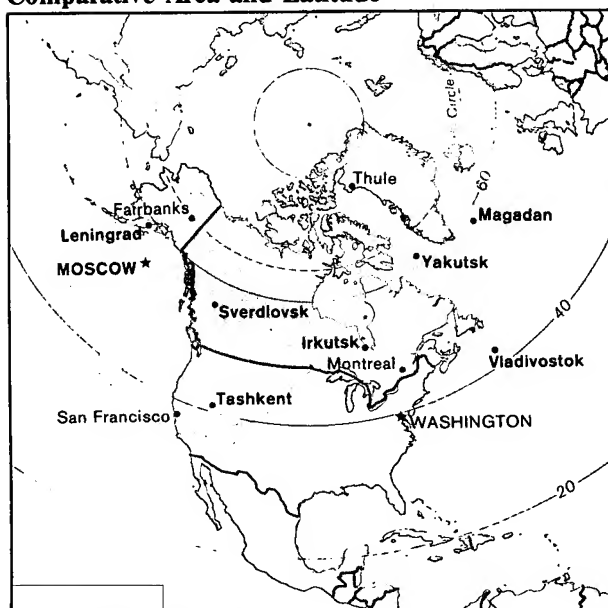
Figure 12
North American Climatic Analogs for Soviet Crop Regions



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Figure 13
Comparative Area and Latitude



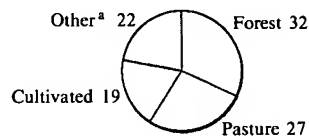
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Figure 14
Land Use, 1984

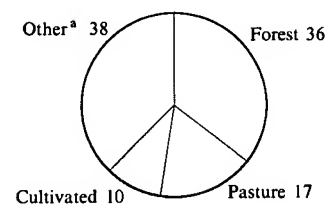
Percent

US

Total: 9.4 million square kilometers

**USSR**

Total: 22.4 million square kilometers



^a "Other" includes mountain, swamp, desert, industrial, and urban areas.

Note: Totals do not add to 100 because of rounding.

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How Does Soviet Agricultural Performance Compare With That in the United States?

Overall, Soviet net farm production rose from 60 percent of US output in 1950 to a peak of 90 percent in the early 1970s. But slower growth in the 1970s and early 1980s, combined with substantial US gains (table 4), dropped Soviet agricultural production to two-thirds of US output in 1982. []

Even in climatically similar areas, yields for most major crops in the USSR are below those in the United States, as shown in table 5. Nevertheless, by 1983 the USSR had outstripped the United States in the production of several important agricultural commodities, such as wool, potatoes, milk, hogs, wheat, and cattle (figure 15). []

Soviet agriculture has been on average far less efficient than its US counterpart. Increases in the factors of production—land, labor, fixed capital, and materials purchased from outside agriculture—have been larger than increases in output. This is because the Soviets use these factors relatively inefficiently. In contrast, growth in farm output in the United States has consistently been more rapid than growth in goods and services used in production. []

Western scholars, furthermore, have estimated that the combined productivity of labor, land, and other productive assets in Soviet agriculture is about one-half to two-thirds of that in comparable areas of North America. Higher US productivity meant that in 1983 one US farmer supplied 66 people—more than seven times the number of people supplied by a Soviet farmer (figure 16). Part of the reason for the

Table 4
US and USSR: Changing Productivity
in Agriculture

Average annual percent change

	1951-60	1961-70	1971-75	1976-80	1981-82
Net farm output					
USSR	5.3	3.0	1.6	0.3	2.5
US	2.1	1.1	2.4	1.4	5.2
Factor inputs ^a					
USSR	2.7	1.7	2.5	1.7	2.0
US	0.1	NEGL	0.5	1.2	-1.5
Factor productivity					
USSR	2.5	1.3	-1.0	-1.4	0.4
US	1.9	1.1	1.9	0.2	6.2

^a Inputs include labor, fixed capital (buildings, structures, machinery, and equipment), materials purchased from outside agriculture (fuels and lubricants, electric power, fertilizer, some processed feeds, and current repairs of machinery and buildings), land, and livestock herds. The several inputs are aggregated into a geometric production function of the Cobb-Douglas type, in which each input is weighted according to its relative contribution to total output in the period.

Note: Growth rates are measured in indigenous currencies. Because of wide fluctuations in annual farm output, we calculated the Soviet data using a three-year moving average for the base and terminal

year in each period. Farm output includes all crops produced during the year except hay and pasture, hayseeds, pasture seeds, and covercrop seeds. It also includes the net production of livestock other than draft animals. Net livestock production is the gross production of livestock products and inventory change minus the value of products (grain, potatoes, vegetables, and milk) fed to livestock and minus the value of hatching eggs. These deductions were made to avoid counting feed crops twice—in the production of both livestock and crops—and to avoid counting hatching eggs as part of poultry meat production as well as of egg production. For 1984 production, see figure 15.

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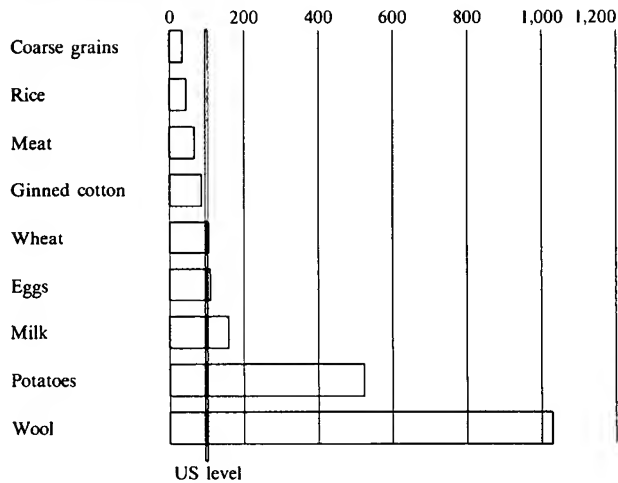
Table 5
US and USSR: Average Annual
Crop Yields, 1976-80^a

	USSR (metric tons per hectare)	United States (metric tons per hectare)	Soviet Yield as a Percent- age of US Yield
Wheat	1.5	1.8	83
Potatoes	11.8	17.3	68
Sunflower seed	1.2	1.4	86
Hay	1.8	4.0	45

^a Selected crops in US and Soviet regions with similar soil and climate.

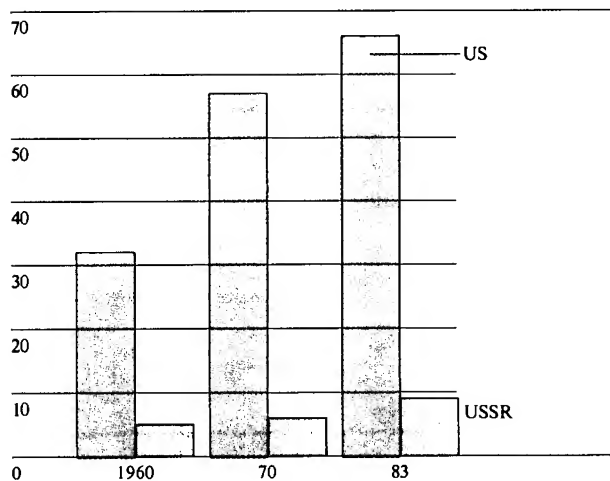
Figure 15
Agricultural Production, 1984

Soviet as a percentage of US



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Figure 16
Number of Persons Supplied by
One Farmworker, Selected Years



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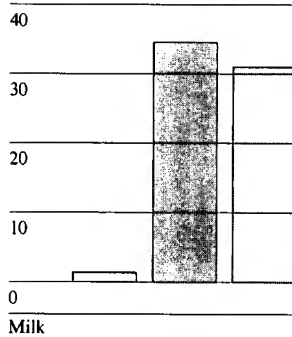
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Figure 17
Labor Requirements for Agricultural
Production, 1979-83 Average

Man-hours per hundredweight

☐ US farms
☒ Soviet collective farms
☐ Soviet state farms

Cotton (seed basis)



Potatoes

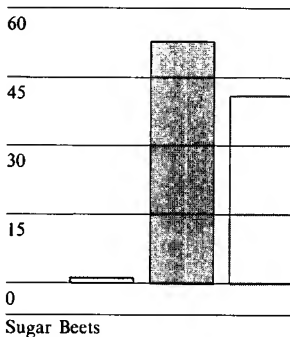
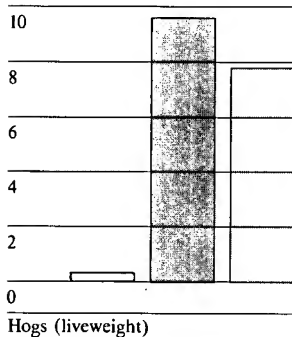
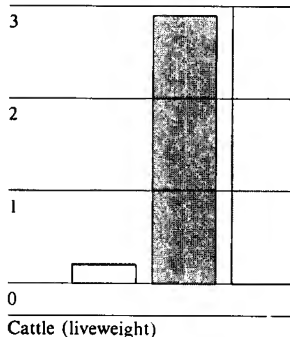
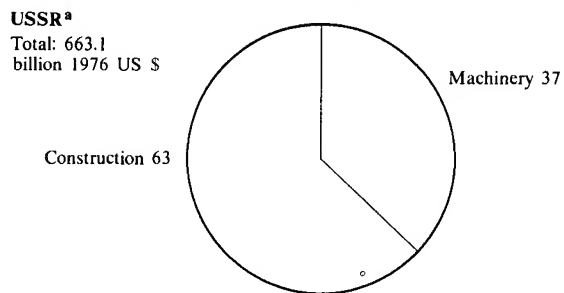
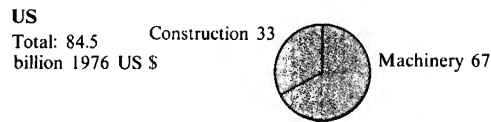


Figure 18
Investment in Agriculture,
1976-83

Percent



^a Total investment for the USSR reflects the geometric mean of the ruble and dollar comparisons. Shares for machinery and construction are derived from investment data in rubles.

Table 6^a
USSR: Incremental
Capital-Output Ratios
Percentage change by five-year period

	Agriculture	Industry
From 1966-70 to 1971-75	136.8	12.0
From 1971-75 to 1976-80	217.8	39.3
From 1976-80 to 1981-83	146.9	74.4

^a With the incremental capital-output ratio for a given period calculated, for example, as:

$$\frac{\text{Average capital stock (1966-70)} - \text{Average capital stock (1961-65)}}{\text{Average output (1966-70)} - \text{Average output (1961-65)}}$$

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Figure 19
Agriculture's Share of Real GNP,
Labor Force, and Total Investment,
Selected Years

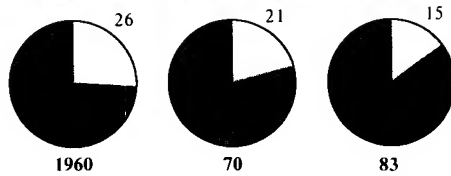
Percent

Real GNP (measured at factor cost)

US



USSR

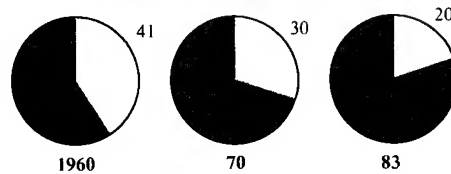


Labor Force

US

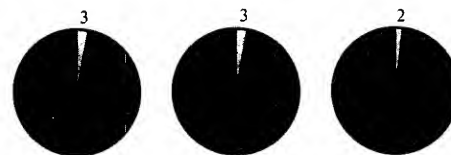


USSR

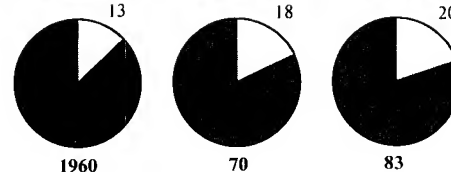


Total Investment

US



USSR



lower productivity of Soviet agriculture is that it is highly labor intensive (figure 17). The relatively greater share of agricultural investment devoted to machinery in the United States has reduced the amount of labor required in agricultural production; two-thirds of US agricultural investment during 1976-83 went to machinery, compared with only one-third in the USSR (figure 18).

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The Soviet agricultural sector contributes much more to Soviet GNP than US agriculture does to US GNP. During the last decade, it was the third-largest sector, after industry and services. Agriculture is a major claimant on Soviet resources (figure 19). It absorbs roughly 20 percent of the labor force (almost seven times the proportion in the United States). Agriculture's share of total Soviet investment increased from 15 percent in 1961-65 to 20 percent in 1976-80 (and is about 20 percent in the 1981-85 Plan). The productivity of capital invested in agriculture is lower than in industry, and falling. The USSR has to invest increasing amounts of capital per unit of output and must do this at a higher rate in agriculture than in industry (table 6).

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Why Did Soviet Agricultural Production Slip in the 1970s?

The Record

During the 1970s, average annual rates of growth in Soviet farm output fell below rates achieved in the United States, Canada, and all of the East European countries. This was a significant reversal: in the late 1960s the Soviet rate exceeded that of those countries. As a result of this deceleration, growth in farm output (especially in the output of livestock products) has failed to match the rapid growth in the Soviet demand for food since the mid-1970s (figure 20). The regime, continuing its emphasis on the need to increase production of livestock products, began to import record quantities of grain to boost feed supplies, but meat production in 1980 was less than 1 percent higher than it had been in 1975. Milk production declined steadily during 1978-80. []

Moscow responded to the deteriorating performance in agriculture by increasing its hard currency outlays on farm products. In the late 1960s and early 1970s, the USSR was a net exporter of grain and meat, but within 10 years it became the world's largest importer; by crop year 1981/82, grain imports reached 46 million tons and meat imports nearly 1 million tons. During 1979-84, Moscow spent nearly 56 billion rubles (more than one-third of its total hard currency import bill) on imports of farm products. In 1983 net imports were equivalent to 10 percent of total farm product availability. Per capita availability of farm products increased during 1976-80—and nearly all of the boost was attributable to a doubling of net agricultural imports. []

Causes of the Downturn

The near stagnation of Soviet farm output in the last half of the 1970s and the early 1980s is related partly to a deterioration of weather conditions. Climate data suggest that unusually favorable weather was a major source of growth in output of farm products from 1964 to 1974. The weather during 1979-82 was on average much less favorable than that in 1964-74 and was also less favorable than the long-term average. Nevertheless, in recent speeches, Soviet leaders have indicated that yields should have been higher despite the weather. []

Inefficiency, poor management, and other factors unrelated to climate have contributed to the slowdown in production growth. In general, these factors can be summarized as:

- A failure to keep up the rate of growth in inputs—the goods and services used in farm production.
- Less efficient use of these inputs—a decline in their productivity. Machinery downtime increased, and weight gain per unit of livestock feed declined.
- Agriculture's increasing dependence on the rest of the economy for inputs and the efficient distribution of its products. Synchronizing the supply of inputs and the processing of outputs became increasingly difficult, partly because of inadequate rural infrastructure, especially roads. []

The principal barriers to more efficient use of resources in Soviet agriculture are:

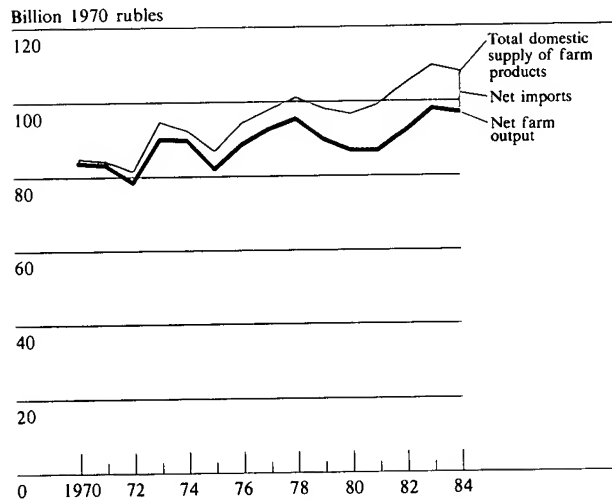
- Centrally determined quotas for output of farm products and for goods and services used in farm production.
- Interference by party officials and bureaucrats in day-to-day farm operations.
- The administratively controlled prices, both for goods and services sold to farms and for farm products.
- Lack of an indicator that takes into account product quality and production cost to replace gross farm production as the most important determinant of success.
- Poor rural living conditions, which encourage skilled farmworkers to leave farms and migrate to urban areas. []

Soviet leaders are carefully watching moves toward decentralizing management of agriculture in Hungary and China. In these countries:

- Centrally determined procurement plans have been reduced or abolished.
- Farm managers and private producers make some production decisions.
- The government controls the mix of farm products indirectly by manipulating procurement prices. []

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Figure 20
Value of Soviet Net Farm Output
and Net Farm Product Trade, 1970-84



most part do not share the confidence of Chinese and Hungarian leaders in the ability of local farm managers and private producers to make the "correct" production decisions. For example, local party officials continue to interfere in day-to-day farm operations, even though their interference has been condemned by Khrushchev, Brezhnev, Andropov, and now Gorbachev as reducing farm efficiency.

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In debating the advantages of less centralized management, Soviet writers have noted such undesirable side effects of the Chinese reforms as rural inflation, and they often have rejected Hungarian and other East European experiments on the justifiable notion that solutions appropriate for the small countries of Eastern Europe are not suitable for a country the size of the USSR.

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More important, however, Soviet leaders have a firm belief in their own system. Movement toward market-oriented systems appears to be unacceptable on ideological grounds. The leaders perhaps consider that raising efficiency and lowering costs are less important than avoiding the political risks of weakening central control over economic activity in the important farm sector. Furthermore, Soviet officials for the

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Confidential**Energy**

Energy is vital to economic growth. The USSR is giving increasing attention to its search for reliable and plentiful energy sources, as well as for ways to conserve energy. Energy exports are a particularly critical component of its trade; oil and gas provide over one-half of Soviet hard currency earnings. This section focuses on two fundamental questions:

- *How large are Soviet and US energy reserves?*
- *How does energy production in the two countries compare?*

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The size of the Soviets' energy reserves is important because it establishes their potential to meet domestic requirements and to support exports to client states and hard currency markets. The quality and accessibility of the reserves are key factors affecting the extent to which this potential can be realized. Because of the long leadtimes required for developing energy resources, choices made today will shape the course of Soviet economic growth for a decade or more.

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How Large Are Soviet and US Energy Reserves?

The Soviet Union is exceptionally well endowed with energy resources. For example, its proved oil reserves are the largest in the world outside the Persian Gulf region; in 1984 they were estimated to be over twice as large as those of the United States (figure 21). Soviet natural gas reserves are the largest in the world, accounting for over 40 percent of the world's total (figure 22); in 1984 they were over six times as large as US reserves. The USSR and the United States together control two-thirds of the world's coal reserves.

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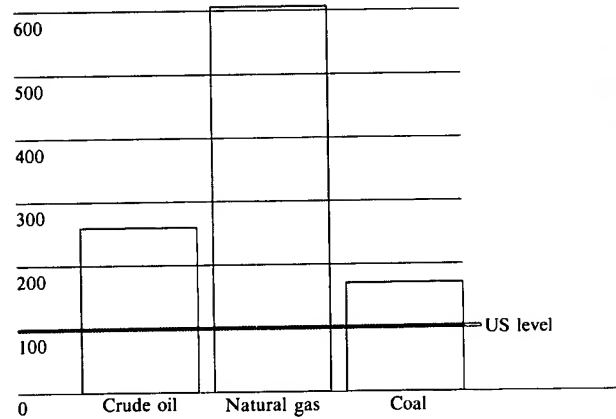
The possession of a large resource base means the USSR will continue to be one of the leading energy producers in the world. But the quality and accessibility of the resources, as well as the quality of technology and equipment and the nature of prevailing economic conditions, are crucial determinants of development potential. For example, the Soviet oil deposits exploited thus far have been of relatively good quality, but most of the remaining reserves are said to be in deeper deposits with lower porosity and permeability and smaller well flow rates. This will hamper extraction in the future—unless better technology becomes available or the Soviets make new discoveries. Accessibility is becoming more of a problem as depletion of the deposits located near centers of large demand forces the Soviets to turn to those in remote regions with harsh climates (figure 23). The costs of extracting and transporting energy increase dramatically with distance from industrial centers, making the energy more expensive and requiring increasingly more investment resources to obtain a given increase in output.

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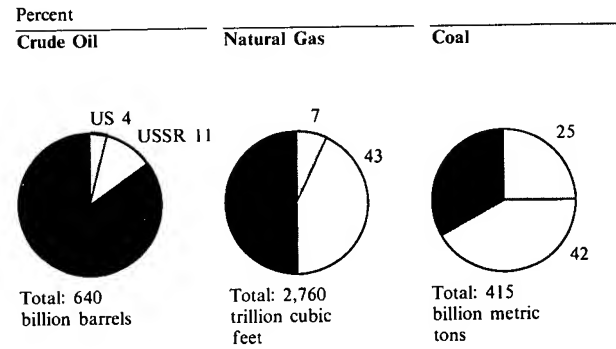
Figure 21
Proved Energy Reserves, 1984

Soviet as a percentage of US
700



Note: Estimates of the size of Soviet crude oil reserves are controversial. The estimate appearing here is the midpoint of a range between 60 and 80 billion barrels. Most recently published US and West European estimates fall within this range.

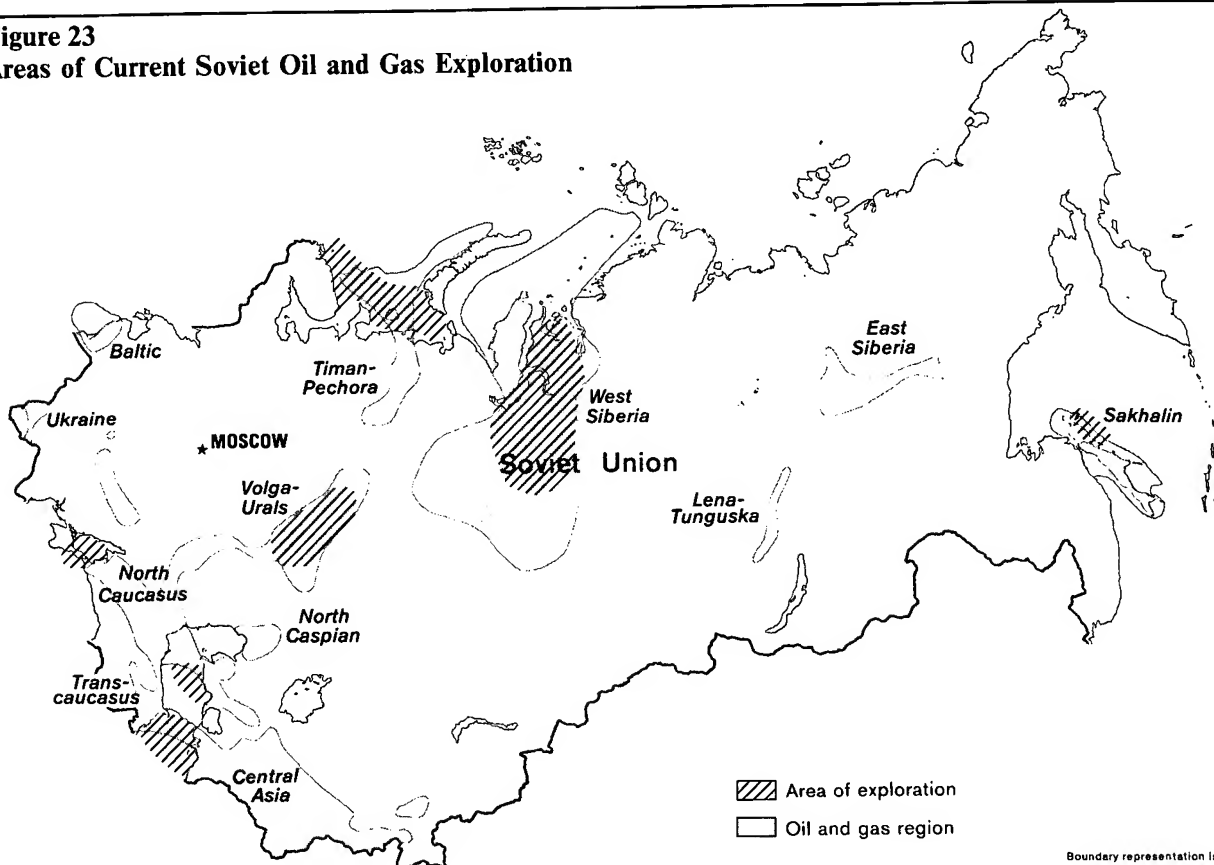
Figure 22
Shares of Proved World Energy Reserves, 1984



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Figure 23
Areas of Current Soviet Oil and Gas Exploration



Boundary representation is
not necessarily authoritative.

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How Does Energy Production in the Two Countries Compare?

In 1984 the Soviet Union produced more energy than any other country except the United States (US production of primary energy exceeded Soviet production by about 10 percent—figure 24). The USSR is the world's largest producer of crude oil and natural gas: in 1984 its oil production was 19 percent higher than US production, and in 1983 its production of natural gas surpassed that of the United States for the first time (figure 25). The United States, on the other hand, produced about 55 percent more hard coal, generated almost 75 percent more electricity, and had nearly three times as much installed nuclear electric generating capacity.

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The United States finds it economical to import some energy to meet the needs of its domestic economy, whereas the Soviet Union does not. In 1983, US primary energy consumption outstripped production by 13 percent, while the Soviets produced nearly 20 percent more energy than they consumed (figure 26). Trends in energy use in the two nations are different, however. US energy consumption per unit of GNP has fallen more than 20 percent since the oil price rises of 1973, while the Soviet ratio increased 9 percent during 1971-80 and has since stabilized. As the US economy shifts away from energy-intensive basic industries toward the provision of services, it uses energy more efficiently. The USSR, on the other hand, continues to develop industry and has failed to institute effective conservation measures.

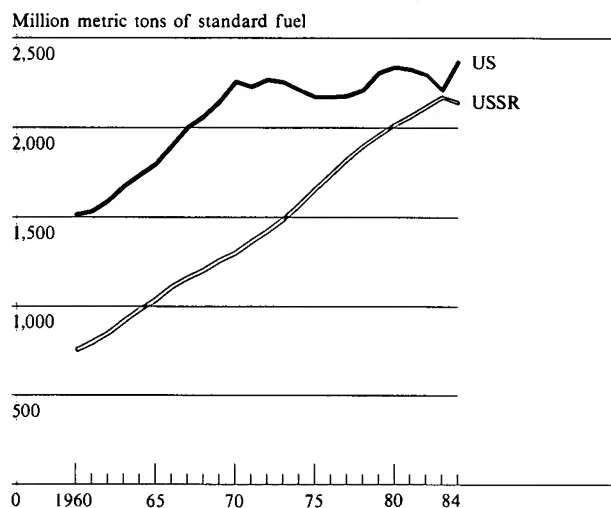
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Earnings from energy exports are an important source of hard currency to the Soviets. Oil and gas provide more than one-half of these earnings. The Soviet Union was the world's largest oil exporter in 1984, and it supplies the bulk of Eastern Europe's energy imports.

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Figure 24
Production of Primary Energy,
1960-84



Note: Data are for coal, crude oil, natural gas, natural gas liquids, and hydroelectric and nuclear power, expressed in terms of standard fuel.

Figure 25
Energy Production, Selected Years

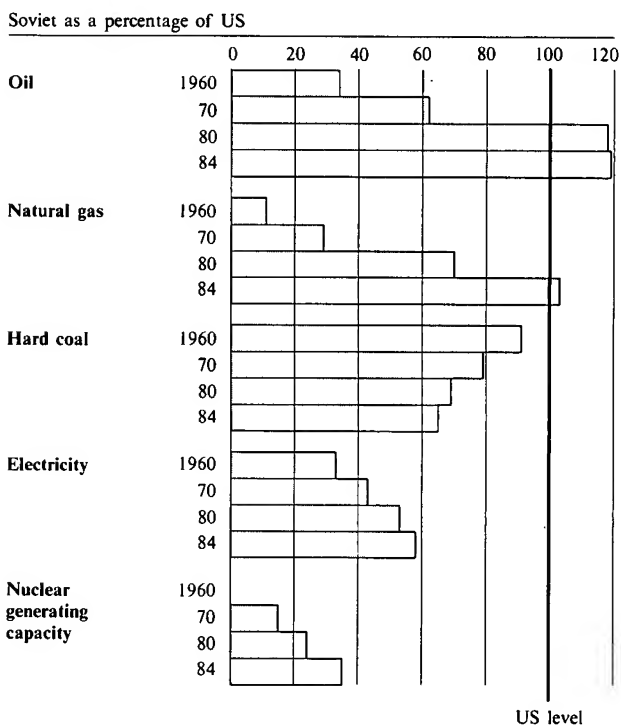
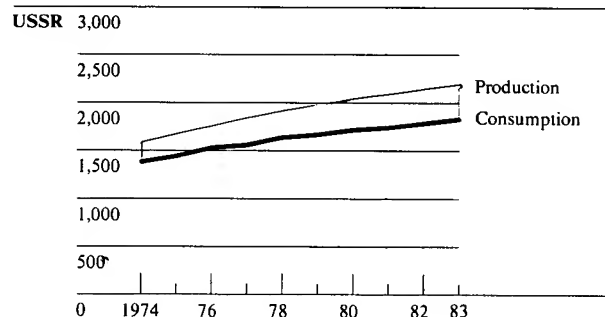
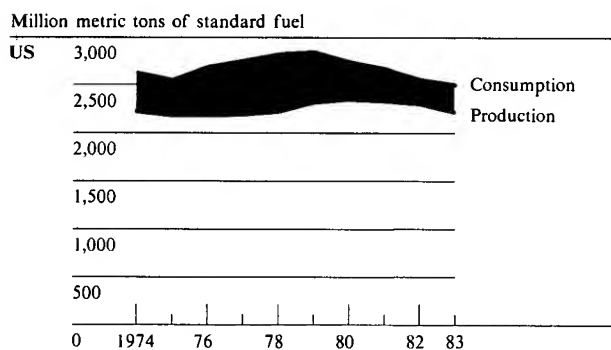


Figure 26
Energy: Dependence on Foreign Suppliers, 1974-83



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Transportation

Confidential**Transportation**

A modern industrial nation needs a well-developed transport system to move raw materials to production centers and final products to market. This section examines the following questions:

- *How much freight does the Soviet transport system carry?*
- *How do the United States and the Soviet Union meet their transport needs?*
- *How much spare capacity is there in the two systems?*

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How Much Freight Does the Soviet Transport System Carry?

The USSR's transportation system carries more freight than any other system in the world. Domestic freight traffic reached 5.7 trillion ton-kilometers in 1984, exceeding the US volume by more than 60 percent.

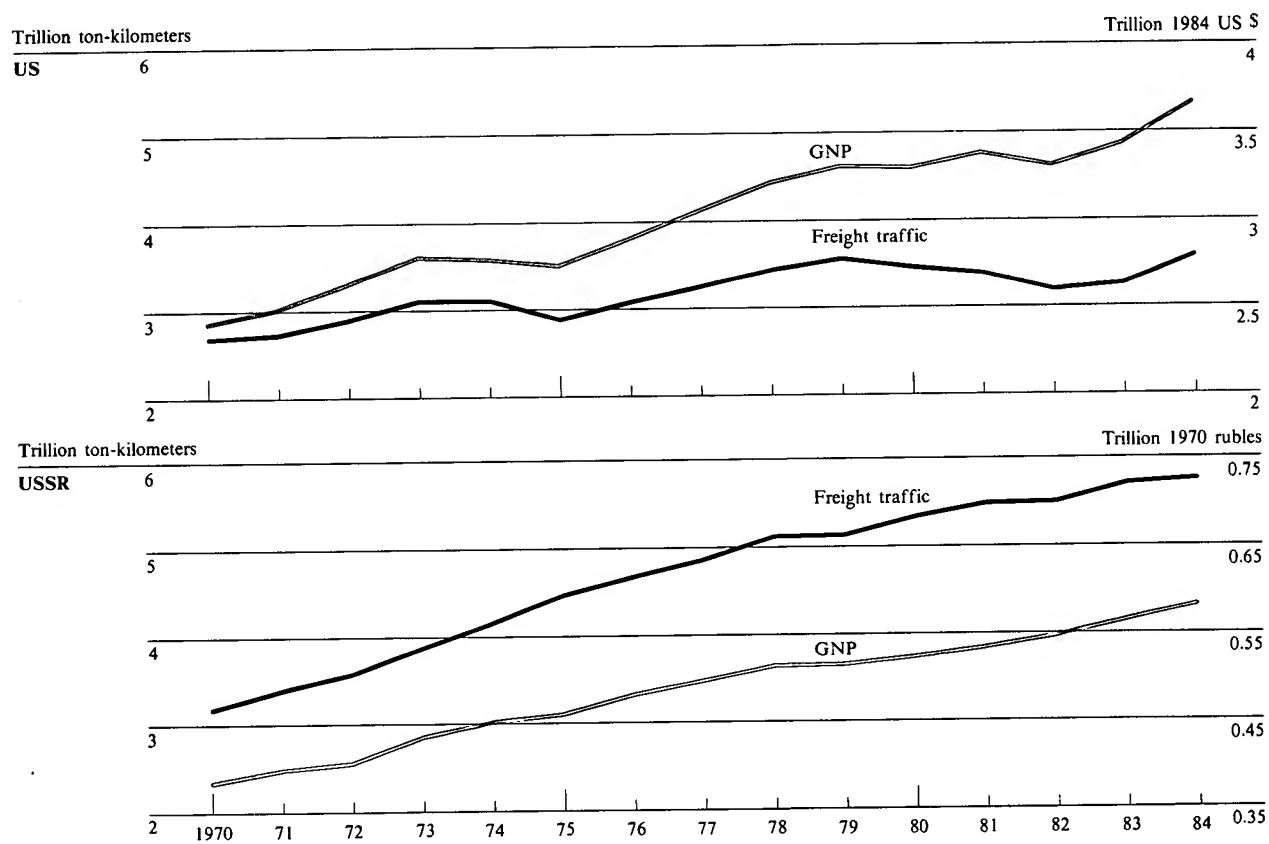
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The Soviet Union depends more on freight traffic than the United States because the development of heavy industry has been given priority, which creates huge requirements for the movement of raw materials and fuels. Moreover, the distances between producers and raw material suppliers are great and increasing, while Soviet policies to economize on freight shipments and to streamline service have been largely ineffective. During 1971-84, the USSR's freight traffic increased by 80 percent—1.6 times Soviet GNP growth (figure 27). In the same period, growth of US freight traffic (34 percent since 1970) was only about 67 percent of US GNP growth. The United States depends less heavily on freight traffic than the USSR because its economy is more oriented to providing services than to heavy industry.

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Figure 27
Trends in Freight Traffic and GNP, 1970-84



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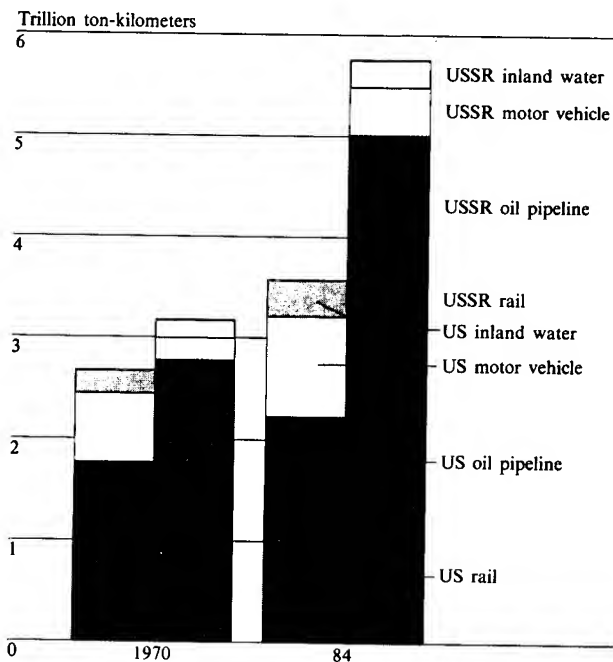
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How Do the United States and the Soviet Union Meet Their Transport Needs?

Transport demands of heavy industry are best met by railroads, waterways, or pipelines. Moscow has emphasized railroads and oil pipelines, which have accounted for the bulk of Soviet freight traffic—87 percent of the total in 1984 (figure 28). Emphasis on pipelines since 1970, however, has reduced the burden of traffic growth on the railways. In 1970, railroads accounted for 79 percent of all freight traffic and pipelines for 9 percent; in 1984 railroad traffic dropped to 63 percent and pipeline movements rose to 24 percent of the total. Although the USSR is richly endowed with water resources, many of the navigable rivers are unfavorably located or frozen over for long periods of the year. Soviet highways—still in their infancy—carry only a small fraction of all freight traffic.

The United States has more favorably located water routes, and its production structure places more emphasis on light industries and services. Meanwhile, US firms have greater incentives to speed up freight service and hold down costs. These factors have promoted intense competition and have created a more balanced distribution among freight carriers. US railroads carry more than one-third of freight traffic, highways and pipelines about one-quarter each, and waterways about one-tenth.

Figure 28
Composition of Freight Traffic,
1970 and 1984



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How Much Spare Capacity Is There in the Two Systems?

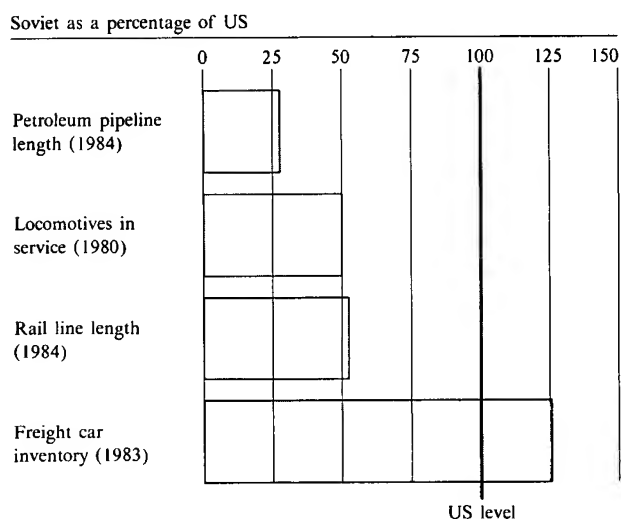
A large part of the USSR's investment in transportation in the last 15 years has gone to pipelines. Since 1970 the length of its petroleum pipelines has doubled, to 76,200 kilometers (km). Although the Soviet system appears to be dwarfed by that of the United States, which is more than three times as long, it carries 55 percent more traffic: the Soviet pipeline system moves crude oil through large-diameter pipe over long distances to refineries, leaving the transport of refined products largely to the railroads. In the United States, on the other hand, more of the refineries are near crude oil production areas or receiving terminals, and more of the pipeline capacity is used to deliver refined products through smaller diameter pipe.

Although development of oil pipelines reduced the traffic burden on the Soviet railways, it probably also robbed the railroads, as well as other carriers, of capital needed for expansion. Soviet railroads carry three times as much freight as their US counterparts, but because investment has been required elsewhere, they have not developed a comparable advantage in either inventory of rolling stock or rail tackage. The USSR maintains 144,000 km of railway lines—only 53 percent of the US system (figure 29). It has an estimated 1.9 million freight cars; this is 23 percent more than the United States has, but the cars are smaller, and the fleet's aggregate carrying capacity (118 million tons) is 7 percent smaller than that of the US fleet.

The working fleet of Soviet locomotives is about half the size of the US locomotive fleet. More than half the Soviet fleet is composed of powerful electric locomotives, which push the total horsepower of the Soviet fleet above that of the diesel-electric US fleet. This small advantage in horsepower pales, however, in comparison with the relative traffic burdens of the two countries. These factors suggest that the United States has ample capacity throughout its rail system to support additional traffic requirements, while the Soviet system is pushed to its limits. Traffic densities (measured in ton-kilometers per kilometer of track) in the USSR are five times those in the United States, and the Soviets are struggling with chronic shortages of freight cars.

As already noted, the USSR lags far behind the United States in the use of roads and rivers for moving freight. The total length of its road system, despite the USSR's vast area, is only 20 percent that of the US system. Hard-surfaced highways—under the liberal Soviet definition—account for only about 55 percent of the USSR's road system; the United States has more than six times as much mileage in hard-surfaced roads. Although the Soviets have an advantage in potential water routes, many of these are located in Siberia far from where transport services are needed. Even on the more accessible rivers, much investment in docks, dredging, ice clearing, and all-weather navigational devices would be necessary before the rivers could become a significant alternative to the railroads for most freight shipments.

Figure 29
Stocks of Transportation Equipment



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Foreign Trade

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Foreign Trade

The role of foreign trade in the Soviet and American economies can be illustrated in general terms by the answers to the following questions:

- *What is the magnitude of foreign trade in the Soviet Union and the United States?*
- *Who are the principal trading partners of the two countries?*
- *How does the composition of US and Soviet foreign trade differ?*

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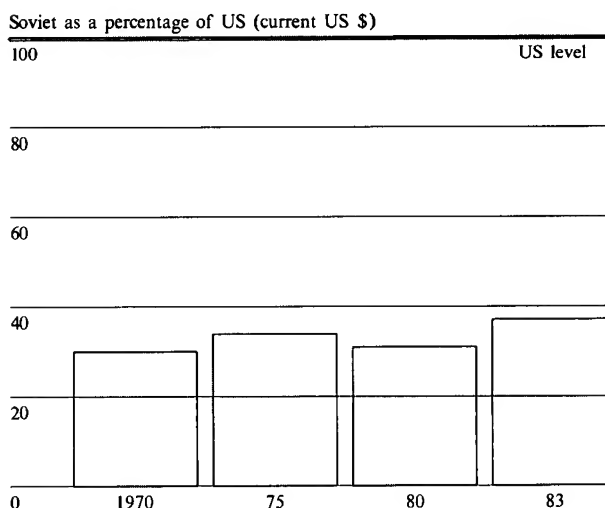
What Is the Magnitude of Foreign Trade in the Soviet Union and the United States?

The USSR plays a relatively minor role in international trade. In 1983, Soviet trade turnover was equal to only 37 percent of that of the United States, and in earlier years it was even less (figure 30).⁵ In both countries, however, total trade turnover accounts for less than 20 percent of GNP.

During the 1970s, the value of both US and Soviet foreign trade grew by about 19 percent per year (expressed in current dollars). While annual growth in US trade was relatively steady throughout the period, the annual rate of increase of Soviet foreign trade fell from 24 percent during 1971-75 to 16 percent during 1976-80. Since 1980, US foreign trade has leveled off while Soviet foreign trade has continued to rise—4 percent per annum between 1980 and 1984.

⁵ Soviet foreign trade figures are estimated in terms of the value of the trade ruble, which differs from the domestic ruble. There is considerable dispute in the West about the relationship between the values of trade and domestic rubles; we have yet to estimate the value of Soviet foreign trade in terms of actual purchasing power, which would allow for an estimate of the share of foreign trade in national income.

Figure 30
Total Trade Turnover, Selected Years



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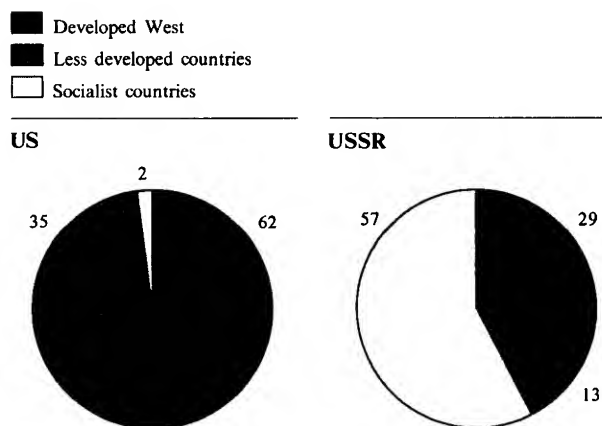
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Who Are the Principal Trading Partners of the Two Countries?

Both the United States and the USSR trade primarily with countries that have economic systems and levels of development comparable to their own (figure 31). In 1984, for example, 57 percent of Moscow's trade was with other socialist countries (notably Eastern Europe), and 62 percent of US trade was with other developed countries (the OECD members). East Germany and Czechoslovakia headed the USSR's trade list, accounting respectively for 10 percent and 9 percent of the total Soviet trade turnover. West Germany was Moscow's largest Western trade partner, with 6 percent of total trade turnover. Canada and Japan are the United States' largest trading partners. Together they account for one-third of the total US volume of trade.

For both countries, however, the current trade situation is more diversified than it was in the early 1970s. Moscow's diversification has been toward the developed West, while its share of trade with the less developed countries (LDCs) has increased little. Most of the 1970s shift in US trade favored the LDCs, chiefly OPEC countries; oil and manufactures were the most important commodities represented in this shift. US trade with socialist countries remained minimal—2 percent in 1984.

Figure 31
Share of Foreign Trade by Type
of Trading Partner, 1984



Note: Totals do not add to 100 because of rounding.



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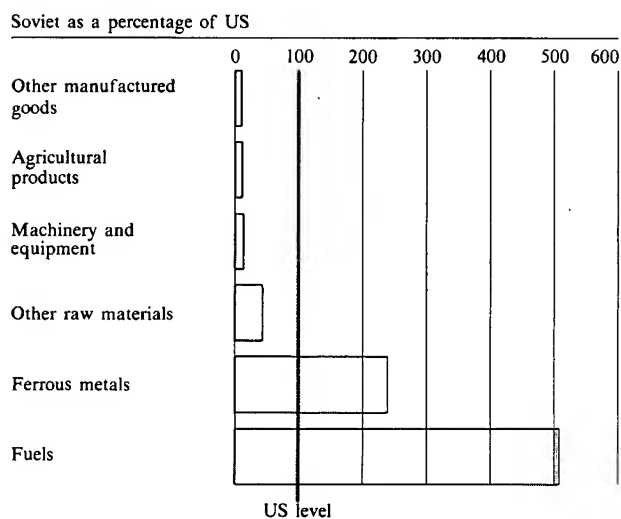
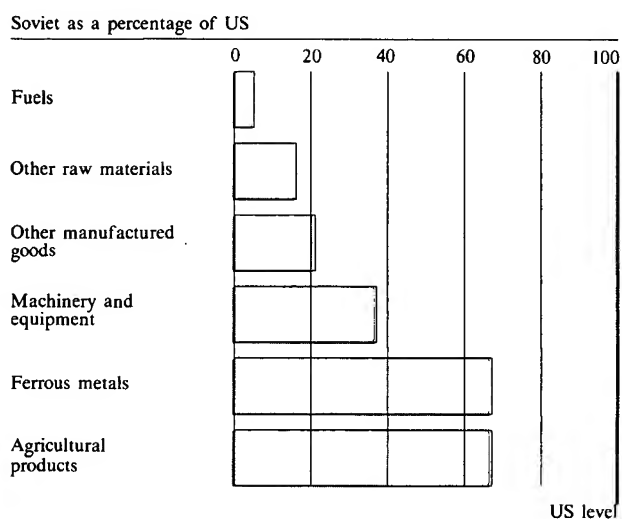
How Does the Composition of US and Soviet Foreign Trade Differ?

US and Soviet export wares are distinctly different (figures 32 and 33). The United States exports mostly manufactured goods, particularly machinery and equipment; the Soviet Union is more like an LDC in that it exports mostly raw materials, particularly energy. This concentration of trade has become particularly prominent since the mid-1970s, as a result of rapidly rising fuel prices. The only raw material products exported by the United States in sizable quantities—just over 20 percent of total exports—are agricultural commodities. Only 5 percent of Soviet exports are agricultural goods. Arms exports are not specified in Soviet trade statistics, but we estimate that this trade accounted for more than 10 percent of Soviet exports in 1983.

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Both the United States and the USSR are primarily importers of manufactured goods. In 1983 these made up more than 60 percent of imports by both countries. In 1980 the US share was below 50 percent, because rising fuel prices had boosted the share of raw materials in total imports. Among raw materials, the USSR imports mostly agricultural products, the United States mostly fuels.

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Confidential**Figure 32**
Exports, 1983**Figure 33**
Imports, 1983

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Demographic
Trends

Demographic Trends

Demographics are fundamental to the environment in which economic policy choices must be made. Such demographic factors as the age composition of the population and the rate of urbanization are important because they affect the economy in many ways: for example, they play a major role in determining the size, location, and composition of the labor force, and they influence the demand for consumer goods and services and health care. This section examines the direction of demographic change in the two countries.

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Population growth in both countries has been declining since the 1950s, but recently the decline has been somewhat more pronounced in the Soviet Union (figure 34). In the 1970s the Soviet population grew on average by less than 1 percent a year, slightly less than the average US rate. The shift is due to declining birth rates in both countries—changes in the death rate had a minimal effect. By 1984 the Soviet population was 16 percent larger than the US population (table 7).

During the 1970s, population growth was rapid in the southern regions of both countries, for different reasons. It was the result of internal migration and immigration in the southern and western United States and of high birth rates in the Soviet Central Asian republics, the Transcaucasus, and Kazakhstan (figure 35).

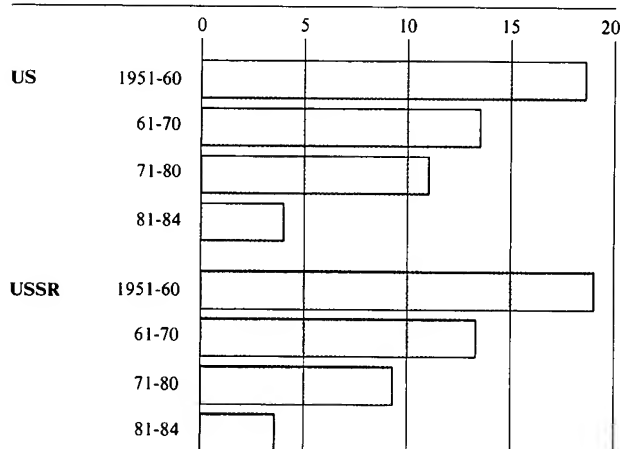
The disparity in regional growth causes more problems for the Soviets than for the United States because the work force is so much less mobile. In

addition, workers in the high-birth-rate republics generally have less education, fewer skills, and less capital to work with than those in other parts of the country. More important, the greatest demand for workers in the 1980s will be in the western USSR, where the labor force is expected to decline. During the 1980s, nearly all of the labor force growth will be in the southern republics—in a conservative cultural group whose young people are unwilling to move to Slavic areas.

Slower population growth is aging the population structure in both nations. The median age in the United States fell from 30.2 years in 1950 to 27.9 in 1970 but rose to 31.2 in 1984. The Soviet median age increased from 24 years in 1950 to 29 in 1980. By the year 2,000, the Soviet population will have aged more rapidly than the US population. The proportion of those 60 and over will rise from 13 to 17 percent in the USSR and from 16 to 17 percent in the United States. Aging populations place greater demands on health care services and social security funds, and

Figure 34
Rates of Population Change, 1951-84

Percent increase over period shown



Note: The base years for these periods are 1950, 1960, 1970, and 1980.

Table 7
US and USSR:
Population in Selected Years

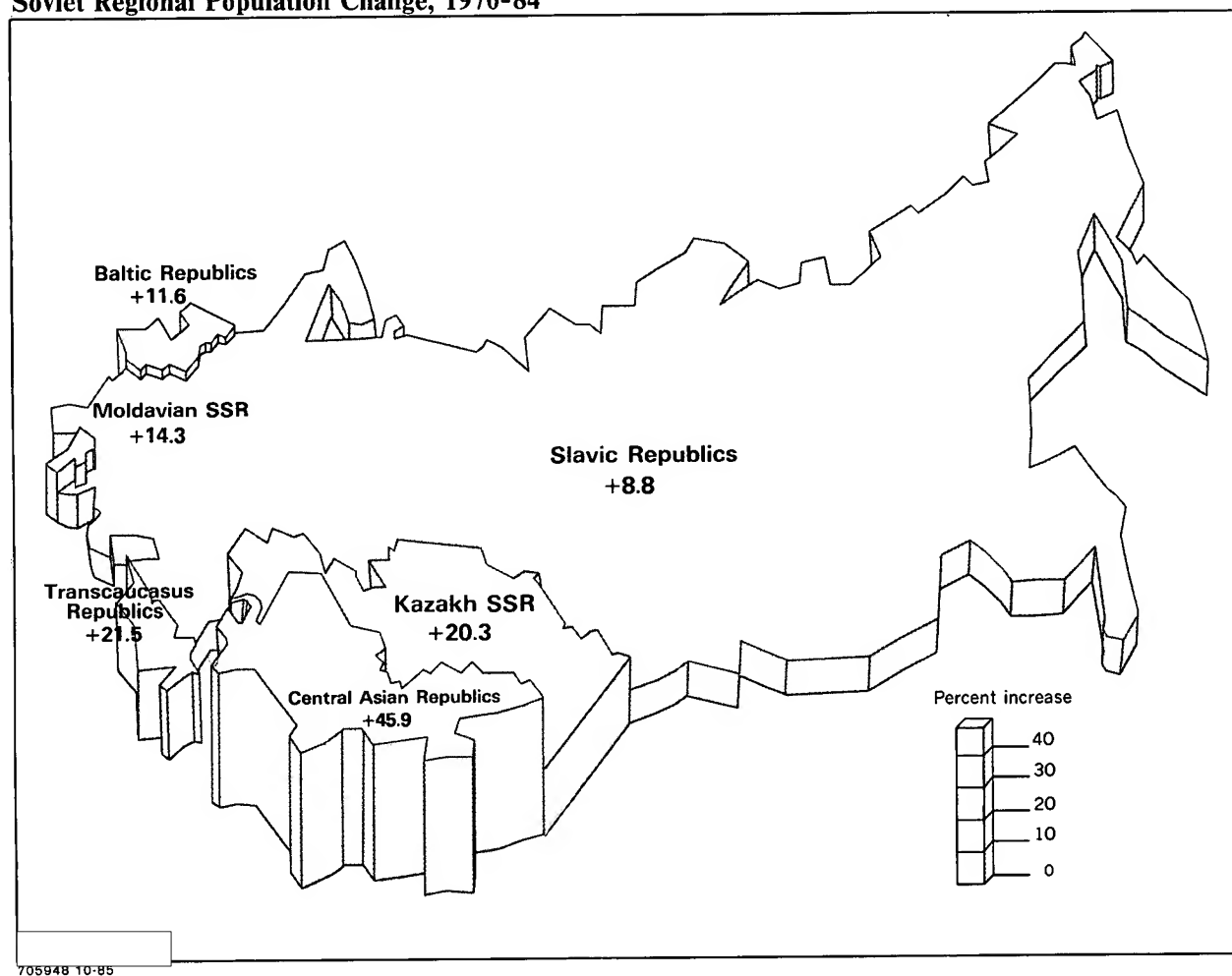
Million persons

	USSR	United States	Soviet Population as a Percentage of US Population
1960	214.3	180.7	119
1970	242.8	205.1	118
1984	275.0	236.7	116

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Figure 35
Soviet Regional Population Change, 1970-84

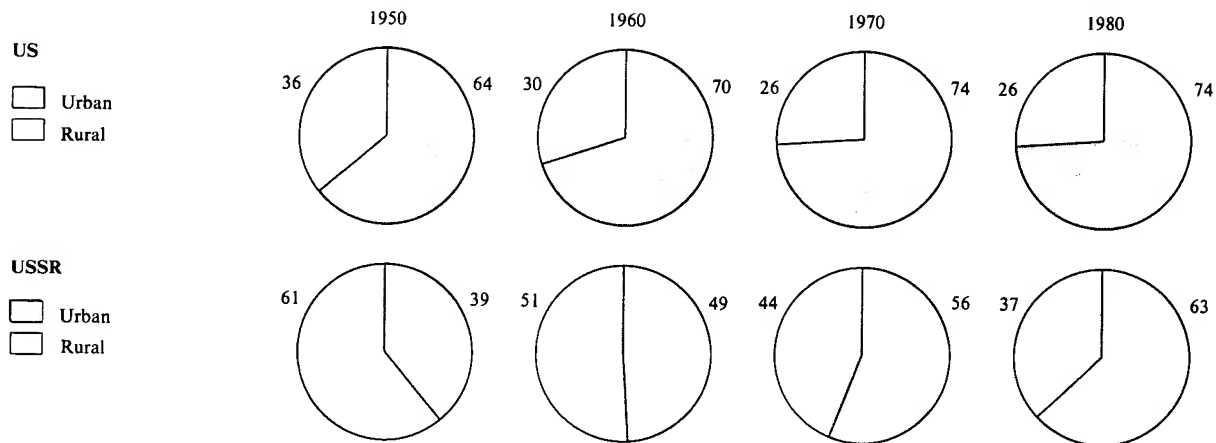


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Figure 36
Urban and Rural Populations, Selected Years

Percent





Note: The US and Soviet definitions of urban and rural populations are not strictly comparable.




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fulfilling these demands requires that national resources be diverted from other uses. This change will have an especially large impact in the Soviet Union, where workers retire earlier than in the United States—women at 55 and men at 60. 


The rate of urbanization in the Soviet Union over the last three decades has been remarkable (figure 36)—the urban population climbed by 140 percent (almost twice the US rate), and its share of the total population is now about equal to the urban share in the United States in 1950. The speed of this change has strained the labor-intensive Soviet agricultural base by drawing off young and better educated farm workers, thereby lowering farm productivity, and has raised the demand for services—which in the Soviet Union means pressure on the government to allocate a greater share of resources to consumption. 

In the USSR, extraordinarily large losses of people during World War I, the Civil War, Stalin's purges and forced collectivization, and World War II altered the age and sex distributions of the population. The

effect is particularly noticeable among males in the 60-74 age group, who are outnumbered more than 2 to 1 by females of that group (figure 37). By comparison, in the United States, females in the 60-74 age group outnumbered males by five to four in 1981. The major aftereffect in the USSR of those large population losses is the reduced number of entrants into the Soviet labor force in the 1980s; in part this is a legacy of the drop in births during World War II. 

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The proportion of the population living in the countryside and working in agriculture is still far greater in the USSR than in the United States. The nature of rural settlement also differs: most US farm workers live in scattered single-family farmsteads and travel into town for entertainment and shopping; in the USSR most rural settlement consists of villages whose inhabitants disperse daily to tend the outlying fields. This difference is being intensified by Soviet efforts to consolidate the smallest villages into larger towns with housing and other amenities more comparable to those in cities. 

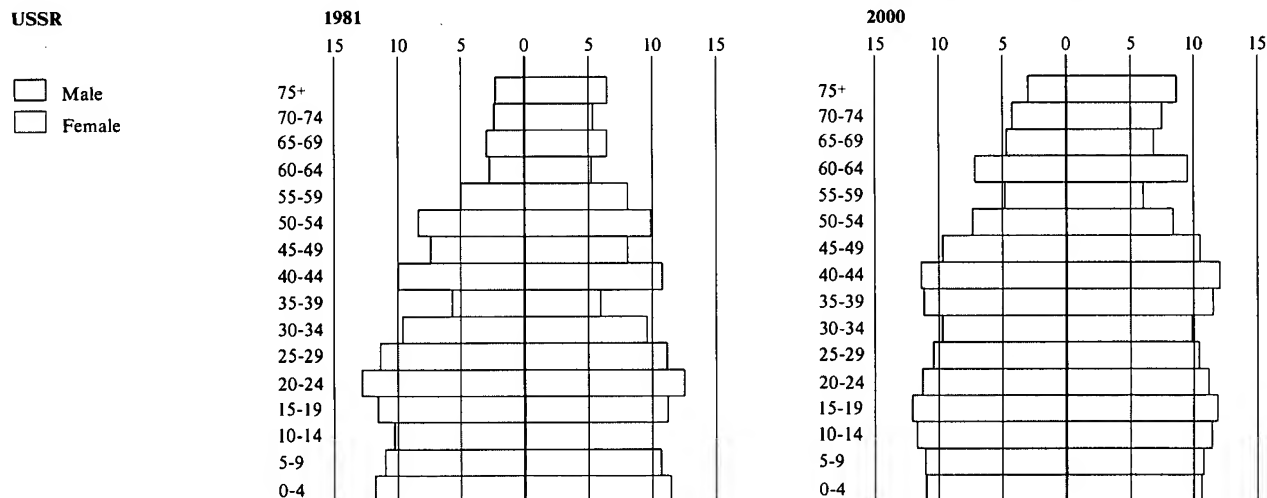
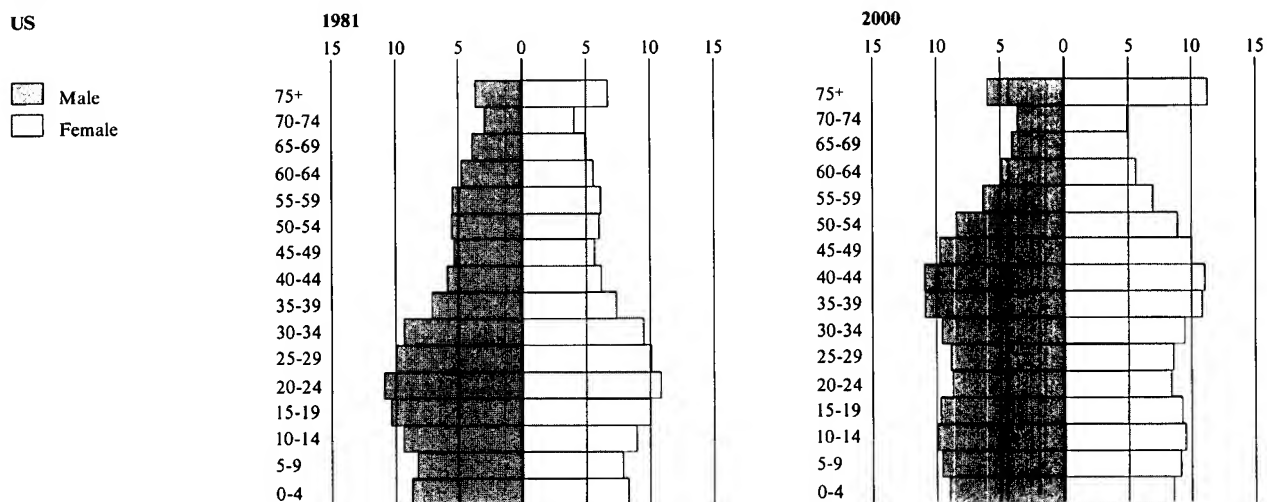
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Figure 37
Age-Sex Pyramids, 1981 and 2000

Million persons



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Labor Force

The size and character of the labor force are important determinants of a country's potential for economic growth. Soviet economic development in the past was based to a substantial degree on rapid growth in the labor force, which in turn was supported by the assimilation of large labor reserves among the rural and female populations and by high rates of population growth. Lately the Soviet advantage over the United States in available labor has diminished. In recent years the primary focus of the USSR's manpower policy has been to bring labor force productivity closer to Western levels through education, organizational change, and—especially—investment in laborsaving capital stock. Although progress has been made in this direction, labor productivity in the USSR remains at a markedly low level compared with the United States. Here we examine these two questions:

- *How have labor force trends diverged in the USSR and the United States?*
- *What progress has the USSR made in raising factor productivity to world levels?*

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How Have Labor Force Trends Diverged in the USSR and the United States?

In 1984 the Soviet population was 16 percent larger than that of the United States, but the Soviet labor force was 32 percent larger (figure 38). This difference arises from the different rates of female participation (figure 39); the Soviet rate is the highest in the world. An increasing share of females of working age have been entering the US labor force, however—a shift that largely explains the gradual fall in the ratio of the Soviet to the US labor force.

Increments in the working-age population of the Soviet Union have dropped sharply in the 1970s and 1980s (figure 40). Fewer children are reaching working age, as a result of the sharp fall in birth rates in the early 1960s, and more adults are reaching retirement age. In addition, males in the prime working years (25 to 44) have been hit by rising mortality rates caused by an increased incidence of alcoholism, industrial accidents, and cardiovascular disease.

Soviet planners can no longer rely on additions to the labor force to support economic growth. Rates of participation in the labor force are already higher in the USSR than in any other industrialized nation (more than 90 percent of working-age adults are at work or in school, 73 percent in the United States), and there is little room for increase. The Soviets have adopted several strategies to increase the labor pool: revising pension laws to make it profitable to work longer, providing child-care services to attract more women, and tapping the military for workers in the civilian sectors. They are also trying to reduce the demand for labor by placing ceilings on the numbers of workers in certain sectors and introducing a variety of incentive schemes. To make young people available for employment at an earlier age, the Soviets in 1984 announced a reform of the educational system. This gives more emphasis to vocational training—a short-term option that may in the long term reduce the supply of highly trained manpower. All these strategies together, however, probably have not offset the changes in the birth and mortality rates.

Population growth is also decelerating in the United States, but the labor supply outlook is much brighter than in the USSR. Average annual increments to the working-age population increased during the 1970s as members of the postwar “baby boom” entered the work force. The rate of increase in the size of the US labor force has been almost steady over the last two decades, in large part because of the rapidly rising entry of females into the work force. And female participation rates could continue to rise, since in 1982 only 74 percent of all US women of working age (using the Soviet definition, 16 to 54 years) were in the civilian work force.

Much more of the Soviet than of the US labor force is engaged in agriculture. In 1984 more than eight and a half times as many people worked in Soviet agriculture as in US agriculture (figure 41); agriculture employed 20 percent of the Soviet and only 3 percent of the US labor force. In both countries, however, the share of the labor force involved in agriculture in 1984 was only half of what it had been in 1960.

Large differences in regional population growth rates are a serious problem for the Soviets, because many workers are reluctant to leave their native republics. The growing labor surplus in the southern republics is therefore not relieving the demand for labor in the western USSR, where the labor force is declining. In addition, workers in the high-growth republics generally have less education, fewer skills, and less capital to work with and are therefore less productive than workers elsewhere.

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Figure 38
Labor Forces, Selected Years

Soviet as a percentage of US

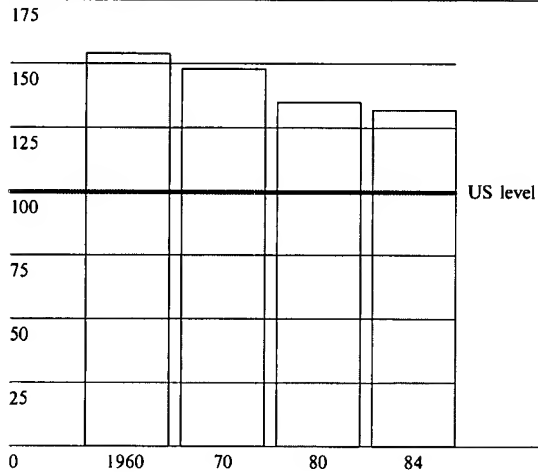
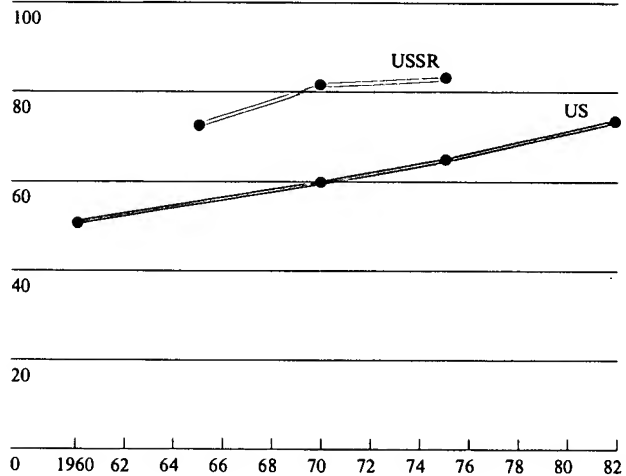


Figure 39
Rates of Female Participation in the Labor Forces, Selected Years

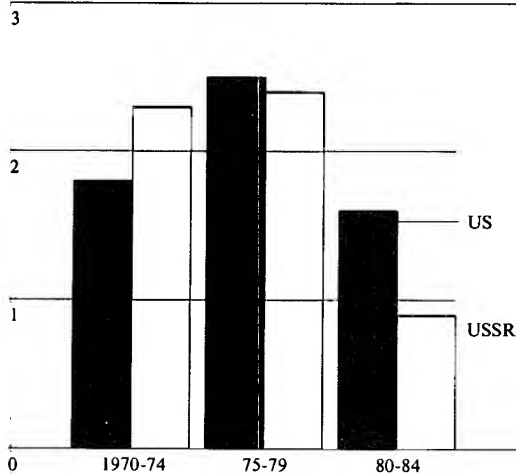
Percent



Note: These figures are based on a Soviet definition of the working age for females: 16-54 years.

Figure 40
Average Annual Increments to the Working-Age Populations, 1970-84

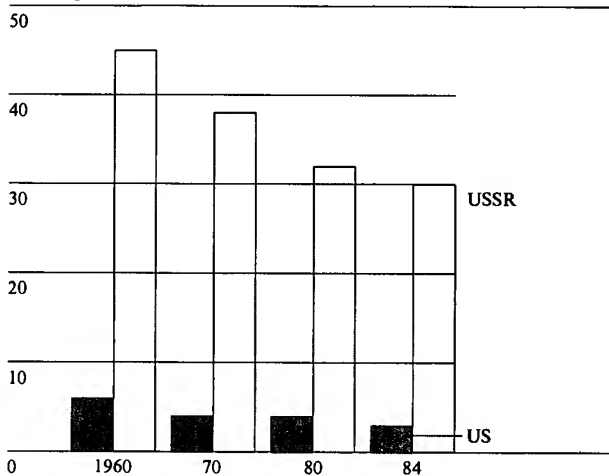
Million persons



Note: The working-age population, according to a Soviet definition, includes males aged 16-59 years and females 16-54 years. Bars show average increments; the base year in each period is the year preceding the one listed.

Figure 41
Agricultural Labor Forces, Selected Years

Million persons



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What Progress Has the USSR Made in Raising Factor Productivity to World Levels?

During 1961-83, Soviet output (GNP) per employee gained on that of the United States but lost ground to the European Community and Japan (table 8). Nevertheless, the level of Soviet GNP per employee is low by US standards; in 1983 it was 38 percent of the US level.

In Western Europe, the emphasis in the 1970s clearly was on increased productivity. The region faced a much slower rise in the size of the working-age population and a much smaller increase in female participation in the labor force than did the United States. In addition, the number of "guest" (foreign) workers in Western Europe declined after 1973. Even so, not enough new jobs were created to keep unemployment from climbing sharply. By 1980 most European countries had jobless rates that matched those of the United States, while in the early 1970s European unemployment had hovered at a low level. In recent years, West European unemployment often has substantially exceeded that of the United States, and there is little prospect for improvement. West European firms focused heavily on laborsaving capital investments because of considerable union and public agitation for much higher wages and greater social-welfare benefits. In fact, real wages were pushed up, well beyond the gains in productivity. Until recently, this factor helped boost economic growth, but it is now undercutting the region's ability to grow and its international competitiveness. The Europeans also have been slower than either the United States or Japan to move from mechanically to electronically based technologies.

In Japan, rapid technological improvements, coupled with forward-looking management, brought a rapid rise in productivity in the 1970s. This permitted large increases in real wages over the years. The demographic pressure for creation of new jobs in Japan was much less than in the United States; indeed, the Japanese female participation rate declined in the 1970s. In addition, the Japanese labor force contains few foreign workers. For much of the decade, the Japanese feared labor stringencies, a factor that gave emphasis to increased investments in laborsaving equipment.

Table 8 *Percent*
Average Annual Growth of Output, Employment, and Capital Stock

	1961-73	1974-83	1961-83
GDP/GNP			
US	4.0	2.0	3.1
USSR	5.0	2.7	4.0
EC ^a	4.6	1.6	3.3
Japan	9.6	3.5	6.9
Employment			
US	1.9	1.4	1.7
USSR	1.4	1.4	1.4
EC	0.2	-0.3	0
Japan	1.3	0.9	1.1
GDP/GNP per employee			
US	2.1	0.6	1.4
USSR	3.5	1.3	2.5
EC	4.4	1.9	3.3
Japan	8.3	2.6	5.8
Capital stock			
US	2.9	1.7	2.4
USSR	8.1	6.9	7.5
EC	4.0	2.7	3.5
Japan	3.5	4.2	3.8
Capital stock per employee			
US	1.0	0.3	0.7
USSR	6.6	5.5	6.1
EC	3.8	3.0	3.5
Japan	2.2	3.3	2.7

Note: GDP (gross domestic product) measures the value of final production produced by resident producers. It differs from GNP in that it excludes the value of production by domestic firms abroad and includes the value of production by resident foreign firms. The value of these differences is relatively small compared with total output, so that for analytic purposes GNP and GDP can be used interchangeably. US, EC, and Japanese data are in 1975 prices. Soviet data are in 1970 prices.

^a The 10 full members of the European Community (EC) are: Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, and the United Kingdom.

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In the United States, many of the economic gains in the 1970s were attributable to putting people to work rather than to increasing productivity. This country was coping with the jobseekers born at the end of the baby boom, a large jump in female workers, and a major influx of immigrants, especially from Hispanic countries. Because labor was relatively cheap, many US firms found it more profitable to increase output by hiring more workers than by investing in new plant and equipment. Other factors slowing the growth of US labor productivity were the end of the shift of labor from the farm to the nonfarm sector, a slowdown in the rate of research and development expenditures, and a decrease in the number of hours worked relative to hours paid. []

In the USSR, productivity growth is declining in all economic sectors. The decline has been sharp in practically all branches of industry, from iron and steel to food processing. There are a number of reasons for this poor performance—some related to worker attitudes and motivation and others to problems in particular sectors. In both cases, the effects reverberate throughout the economy, magnifying endemic problems and creating new ones. []

Worker morale in the USSR is generally poor, and through the early 1980s, at least, it was getting worse. Until recently, the regime has relied on improvements in the standard of living to motivate workers to produce more. Their expectations, however, have far surpassed the regime's ability to provide the good life. Improvements in the quality of the diet—a key indicator by which Soviet consumers judge their level of well-being—have failed to maintain their momentum of the 1970s. Shortages of quality foods, particularly meat and dairy products, have become chronic and are worsening. Having to stand in food lines is reducing workers' efficiency—directly, when they do it during working hours, and indirectly, by causing general frustration and irritation. Getting more money and finding goods and services in short supply has blunted the incentive of additional wages. Another indicator of low worker morale is rising alcoholism, which causes production slowdowns, shoddy workmanship, and growing absenteeism. The effect of low morale on production levels is difficult to quantify,

but a saying popular in the USSR and Eastern Europe captures the probable effect: "Since the government pretends we live better, we will pretend to work harder." []

The physical condition of industrial facilities in the USSR also holds down productivity. Construction delays have held back expansion and modernization of plant and equipment for producing a wide array of industrial products. Equipment shortages and transportation bottlenecks—occurring with increasing frequency and intensity—have aggravated the construction delays. In addition, capital is used inefficiently, with the result that the growth of GNP per employee is lower in the USSR than in the EC or Japan despite higher annual growth rates in capital stock per employee in those countries. For all these reasons, plus a lack of replacement investment and incentives to encourage modernization, Soviet enterprises continue to use obsolete equipment that requires frequent, costly, and labor-intensive repairs. Indeed, the employment of repair workers in industry has grown nearly three times as fast as overall industrial employment. []

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Confidential**Living Standards**

This section addresses a simple question: How well off is the typical Soviet citizen compared with his or her American counterpart? A simple answer cannot be given, yet it is a question of fundamental importance, because it goes to the heart of any comparative study: how well does a country provide for its people? Agricultural and industrial output and GNP growth are yardsticks that have more meaning in the context of their impact on people's material well-being. This section, then, attempts the many-sided task of comparing the relative levels of prosperity enjoyed by Soviets and Americans. First it compares trends in aggregate per capita consumption as a way to combine diverse activities into a single measure. To flesh out this stick-figure answer, however, we then present separate comparisons of diet, stocks of consumer durables, health care, housing, and transportation.

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Confidential**Aggregate Trends in Per Capita Consumption**

The USSR has made some small progress toward catching up with US consumption levels. Over the last two decades, real Soviet per capita consumption inched up relative to that in the United States, though it is still only about one-third the US level (figure 42). Living standards in the USSR remain low by Western standards and even compare unfavorably with those in much of Eastern Europe.

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Soviet per capita consumption, which grew more and more slowly after the mid-1960s, slowed especially sharply in the early 1980s.⁶ This has been the case in all major categories of consumption, particularly in consumer durables. Moscow has been importing more consumer goods—their estimated share in total retail sales nearly doubled during the 1970s—but this was not enough to offset the growing demand for goods and services. As average income increased, widespread gaps between the demand for consumer goods and their availability became increasingly evident. The year 1982 was particularly bad—per capita expenditures on food, soft goods, and durables actually declined from their 1981 levels. All major categories of per capita consumption rebounded somewhat in 1983 and 1984, however.

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⁶ Growth in real per capita consumption is a good general measure of changes in a nation's standard of living because it compares over time the increase in real purchases of goods and services. It cannot indicate the lot of a particular citizen, however, because it cannot account for distribution disparities or regional differences or for the differences in accumulated stocks of housing and consumer durables that help determine living standards.

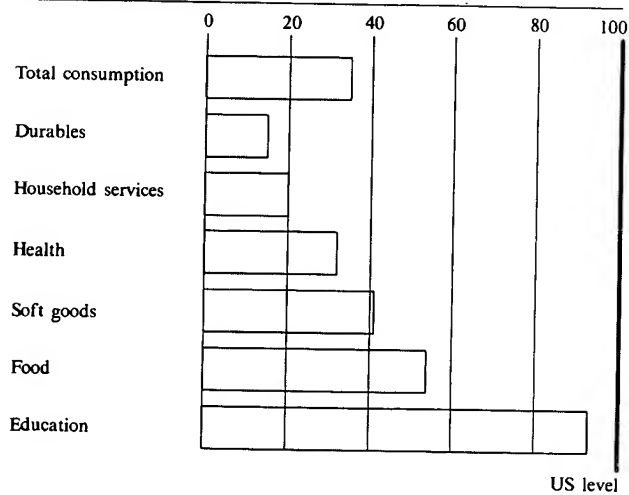
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Figure 42
Per Capita Consumption
Expenditures, 1983

Soviet as a percentage of US



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Confidential**Diet**

Food is perhaps the brightest area in the comparative living standards picture. In 1981 the daily caloric level of the Soviet diet nearly matched that of the United States (figure 43). Soviets consumed more starchy staples than Americans, but the gap had narrowed somewhat. Meanwhile, more livestock products were available; per capita consumption of meat increased 40 percent during 1970-82, although Soviet citizens on average still ate only half as much meat as Americans (figure 44). Soviet per capita protein levels nonetheless nearly matched US levels. Protein in the Soviet food supply increased from one-third to one-half, and recommended daily per capita caloric levels in the USSR were exceeded. The Soviet levels are higher than the US recommended calorie allowances for adults. []

Nevertheless, the large Soviet demand for quality foods remains unmet. Because output of these quality foods is insufficient and state retail prices are low in relation to money incomes, long queues and informal rationing are widespread. In some places, the authorities have invoked a mild form of rationing limiting the purchases of certain foods by state store customers. []

The excess demand for quality foods is reflected in prices at collective farm markets (CFMs), where individuals sell surplus from their private plots and where prices vary according to supply and demand. Prices paid in CFMs are on average more than double the state retail prices. Part of the price difference reflects the superior quality of the products sold in CFMs, and part reflects supply-demand imbalances that have put considerable upward pressure on free market prices. []

The United States does a great deal of food processing—canning, freezing, and drying, as well as specialized processing and packaging. The universal use of refrigeration and a flexible distribution system make fresh foods widely available throughout the year and give US consumers a wider choice than their Soviet counterparts. The USSR's food industry is heavily oriented toward processing food into more storable

forms—canning vegetables and making sausage, cheese, and similar products. Freezing and packaging are at an embryonic stage in the Soviet Union; in 1976, for example, only one-quarter of the food products marketed were packaged. Fresh fruits and vegetables (other than the storable potatoes, cabbages, carrots, beets, and onions) are scarce outside the short harvest season, July through October. []

The most notable Soviet dietary "advantage" is in the consumption of alcoholic beverages. Total per capita consumption of alcohol in the USSR exceeds that in the United States by only an estimated 40 calories per day, but the consumption patterns differ. Soviets drink mostly hard liquor, while Americans drink mostly beer and wine. Hard liquor, mainly vodka, accounted for 70 percent of total consumption of alcoholic beverages in the USSR (it was 20 percent of the US total in the mid-1970s). More important, the Soviet figures omit *samogon* (homemade hard liquor), which has been estimated to be as much as 30 percent of alcohol consumed in the USSR. []

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Figure 43
Diets, Selected Years

Percent

US

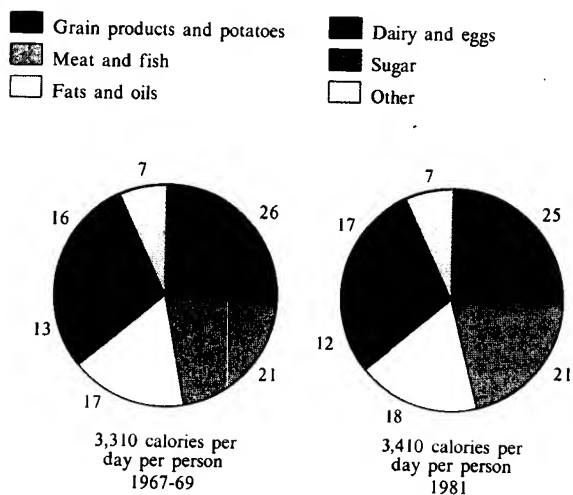
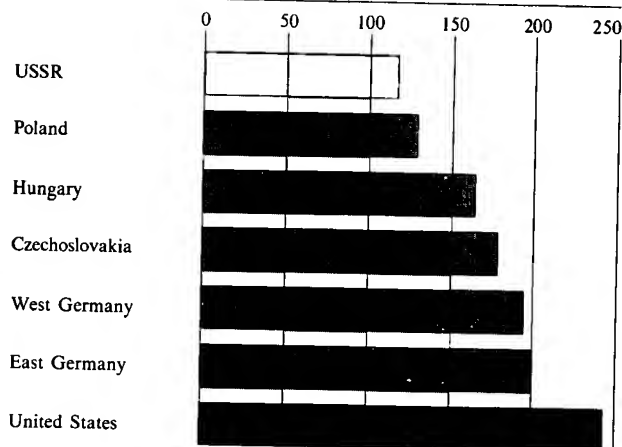


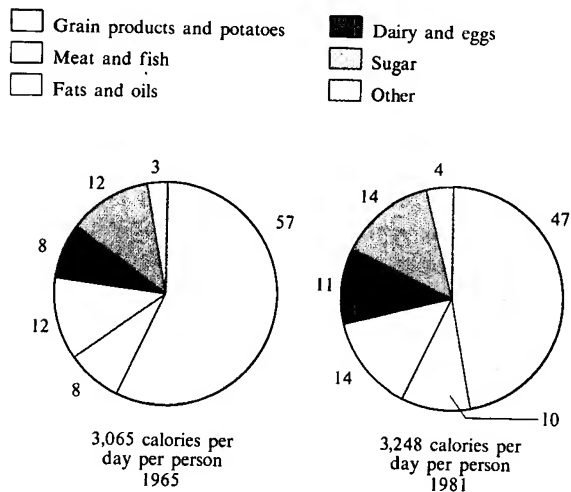
Figure 44
Per Capita Meat Consumption in
Selected Countries, 1982

Pounds



Note: Figures show carcass weight, including offal.

USSR



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Confidential**Consumer Durables**

The gap between US and Soviet purchases of durable goods is still enormous, although it is slowly closing. Overall Soviet per capita expenditures for consumer durables are less than 20 percent of the US level, but they have nearly doubled since 1960. Relative levels of expenditures on durables are generally corroborated by the retail sales data shown in table 9. []

Consumer items incorporating recent technological advances—digital electronic watches, quartz watches, calculators, and video recorders—are common in the West but are not generally available in the USSR. Possession of such items is a mark of prestige. Many of them were not domestically produced until several years after commercial production began in the United States (table 10). []

The USSR mounted a substantial program for producing washing machines in the 1960s and refrigerators in the 1970s (figures 45 and 46). By the mid-1970s, two-thirds of all Soviet families had both, and three-fourths had a television set; in the United States, almost every family has a refrigerator and TV set and about three-fourths have washing machines. []

Soviet writers are becoming increasingly alarmed over the inability of the production system to produce the mix of goods that would satisfy consumer demand at prices close to present levels and over the failure of quality controls at all stages. According to one Soviet economist, "A significant portion of the population consumes much of its time searching for scarce goods." []

Some typical product-mix problems have been noted recently in the Soviet press. According to Soviet figures, about 75 percent of the consumers who wish to purchase refrigerators want models with a capacity of 200 to 240 liters (7 to 8.5 cubic feet), yet only 12 percent of the units produced are of this size. (In contrast, most US refrigerators are twice as large and have freezers.) The industry is manufacturing about 150 percent more small-capacity refrigerators than are needed. Meanwhile, the demand for desired types of furniture is being met at a level of only 85 percent,

according to Soviet figures, while inventories of unsold furniture have increased. Furniture sets of modern design are in high demand. Only 60 percent of the demand for furniture sets is being met; the sale of furniture for the kitchen, such as dinette sets, meets less than 70 percent of the estimated demand. Of the 4 million washing machines produced every year, only 5 percent are fully automatic—little help to harried working women with families; most washing machines require the operator to wring the clothes by hand at least once during the washing cycle. Virtually all US washers are automatic. []

In recent years Soviet planners have stepped up their efforts to ascertain the structure of consumer demand. But even in instances in which demand is predicted correctly, the trade network often is not able to obtain the needed goods. Orders from the trade network for many goods are only fulfilled at a level of 60 to 80 percent by industry; meanwhile, other goods are delivered in excess quantities—including goods not ordered, according to trade officials. []

Just as local party officials often blame the trade network for consumer-goods supply problems, retail trade officials are fond of reproaching industry for delivering the wrong quantity and assortment. Industry officials in turn point to insufficient or late deliveries of the raw materials they need to manufacture consumer goods. There is merit in all of these complaints. But the key to the side-by-side existence of shortages and surpluses is the lack of strong interest by factories in the marketing side of their operations. []

Furthermore, gross value of output and sales indicators used to measure enterprise plan fulfillment have caused additional product-mix distortions. In several cases, industry has been able to increase the value of ruble output without increasing the actual amount of production by raising the share of higher cost goods or by introducing "new" goods with a price higher than justified by changes in production costs. Manipulating the assortment plan in this way leads to retail price inflation, as consumers pay higher prices for goods that are essentially the same as lower priced items no longer available. []

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Table 9
US and USSR: Retail Sales of
Major Consumer Durables, 1982

Million units

	USSR	US
Automobiles	1.4 ^a	8.0 ^b
Television sets	7.0	16.4 ^c
Radios	6.0	44.1 ^c
Refrigerators	4.6	4.4 ^d
Washing machines	3.7	6.4 ^d
Vacuum cleaners	2.9	7.6 ^d
Tape recorders	3.2	28.9 ^d

Note: In 1982 the Soviet population was 16 percent larger than the US population (270 million persons in the USSR and 232 million in the United States).

^a New and used cars; about 80 percent were new.

^b New cars only.

^c Production.

^d Manufacturer's shipments.

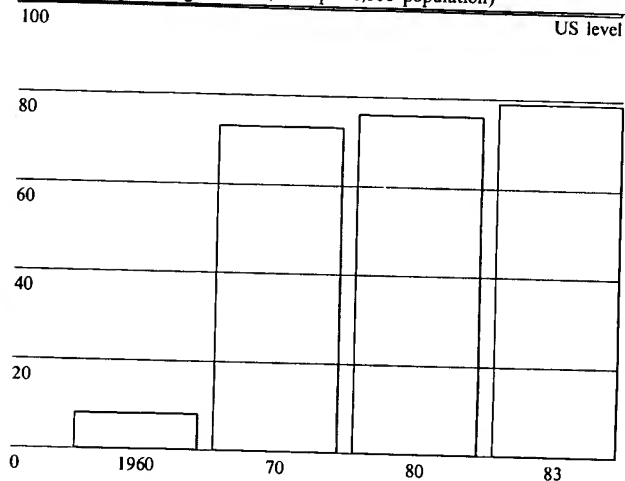
Table 10
USSR: Lag in Production
of Consumer Goods

	Date of first commercial production	
	USSR	West
Color television	1967	1954
Digital electronic watch	1975	1972
Hand-held calculator	1975	1971
Video recorder	1975	1968-69
Quartz electro-mechanical watch	1977	1972

Source: R. Amann, J. Cooper, and R. Davies (eds.), *The Technological Level of Soviet Industry*, Yale University Press, New Haven, 1977.

Figure 45
Washing Machines in Use,
Selected Years

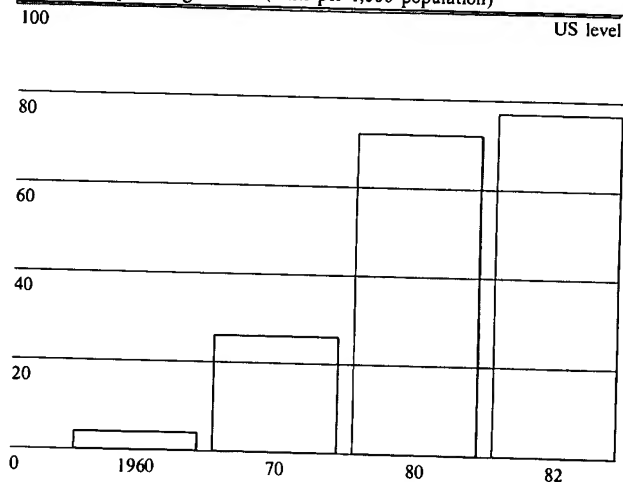
Soviet as a percentage of US (units per 1,000 population)



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Figure 46
Refrigerators in Use, Selected Years

Soviet as a percentage of US (units per 1,000 population)



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Despite much official rhetoric devoted to the need to increase product quality, the results have not been impressive. An article in an issue of the official retail trade journal declared, "The situation with regard to the quality of consumer goods, in our view, not only is not improving, but on the contrary is giving cause for more anxiety as time goes on." The share of output from light industry with the "Seal of Quality"—meaning that the product meets international standards—was 13 percent in 1981.

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Although this is better than the 2 percent cited in the Soviet press for 1975, complaints about product quality at all levels are still endemic and show no tendency to abate. The USSR Ministry of Light Industry, for example, considers 40 percent of the textile industry output in the Russian Republic (as well as several other republics) to be substandard. According to data gathered by trade inspectorates, 15 percent of the furniture produced in the USSR is defective. In 1981, according to USSR Minister of Trade Struyev, spot checks by trade inspectorates of goods delivered to the trade network showed 9 percent of the fabrics and leather footwear and 7.5 percent of the clothes to be of unacceptably low quality.

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Although trade enterprises have the right to reject goods that do not meet the quality standards claimed for them and to exact fines in return, they seldom exercise it. Only obviously defective goods are turned away, and fines usually are not sufficient to compensate for the quality differences. In addition, retail trade organizations must meet sales targets and are thus reluctant to reject goods that they stand some chance of selling. Consumer dissatisfaction with the trade network is not limited to the poor quality of goods. Some of the chronic spot shortages and erratic distribution occur because there is not enough inventory in wholesale organizations to shift goods quickly in response to the shifting requirements of retail outlets.

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Health Care

The USSR has made significant improvements in health care over the past 25 years, but lately it has been having increasing difficulty coping with the changing health patterns of an older, more urban, and more industrial population. As noted in the demographic section, the population in both the United States and the Soviet Union is getting older because of slower population growth. Between 1960 and 1981, the proportion of those 60 and older increased by roughly similar amounts in both countries (table 11); but from 1981 to 2000 aging in the USSR will accelerate, with the share rising from 13 to 17 percent, while the United States will be changing more slowly—rising from 16 to 17 percent. []

Changing patterns of residence and occupation also affect health status. Rural-to-urban migration and industrialization can increase the population's exposure to harmful substances. Changing patterns of consumption, particularly increasing tobacco use and alcohol abuse, also pose health care problems. []

Maintaining health standards in the face of these demographic and social changes calls for devoting a larger percentage of national resources to health care. In the United States, the share of GNP used for health care increased from 5 percent in 1960 to 8 percent in 1983. In contrast, the Soviet share stayed constant at only 2 percent. In comparative terms, Soviet per capita health expenditures fell from less than two-thirds of the US level in 1960 to about one-third in 1983. []

The resources devoted to health care in the Soviet Union were not enough to prevent rising mortality in nearly every population-age group (table 12). The USSR is the only major industrial nation in which life expectancy is lower now than it was 20 years ago. Male life expectancy there is estimated to have fallen from 66 years in 1965 to 62 years in 1982, while in the United States it rose from 70 to 75 years. Soviet males at birth can expect to live 12 years less than Soviet females (figure 47). []

Table 11
US and USSR: Percent of Populations
60 and Over

	US	USSR
1960	13.2	9.4
1981	16.0	12.7
2000	16.9	17.3

Although the Soviet health care system is extensive (37 physicians per 10,000 compared with 19 per 10,000 in the United States) and available to everyone free of charge, the quality of service is uneven. The general public is served by a system of hospitals and outpatient polyclinics that provide a relatively low standard of care. According to several observers and emigres, drugs are difficult to find, hospitals are overcrowded and dirty, and a patient's family must often bring food from home to supplement the hospital diet. Facilities in rural areas are particularly inadequate, largely because qualified personnel find work in outlying regions unattractive. In contrast, a closed system of hospitals, clinics, and dispensaries with superior facilities is administered by the Ministry of Health's Fourth Main Administration for high-ranking party, government, and policy officials. Some ministries maintain their own health service systems, which presumably offer better care and serve as an incentive to attract workers. []

Because of the disparity in health services, some Soviets are opening their pocketbooks to buy better, more personalized care than the state provides them free of charge. The few legal fee-for-service clinics are apparently heavily used, and under-the-table payments to medical personnel are pervasive. An illegal payment of 1,300 rubles, for example, may be necessary to ensure that a patient gets a surgeon with above-average skill. Beyond health care availability,

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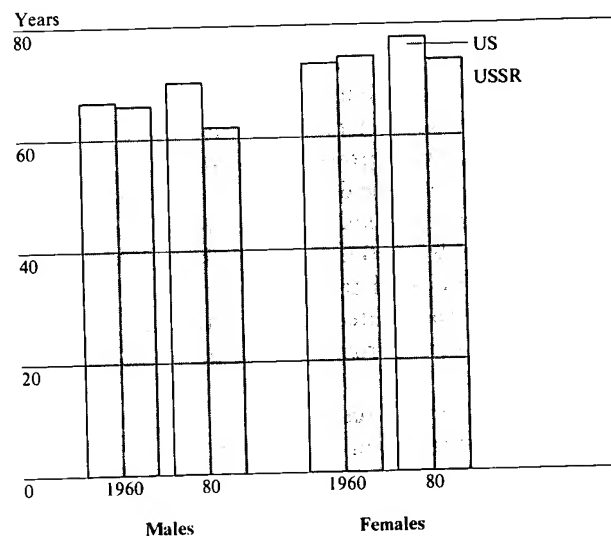
Table 12
US and USSR: Change in Mortality
by Age Between 1966 and 1976

Deaths per 1,000

	US	USSR ^a
0-1	-7.4	5.0
0-4	-1.7	1.8
5-9	-0.1	-0.1
10-14	-0.1	-0.1
15-19	0	0
20-24	0	0.1
25-29	-0.1	0.1
30-34	-0.3	0.4
35-39	-0.4	0.6
40-44	-0.5	1.4
45-49	-0.8	1.8
50-54	-1.4	1.4
55-59	-2.2	2.3
60-64	-2.2	1.7
65-69	-6.1	2.5
70+	-11.8	9.2

^a The last year for which the USSR published mortality data by age was 1976. Soviet data are given as two-year averages—for example, 1965-66 for 1966; from Murray Feshbach, *The Soviet Union: Population Trends and Dilemmas*, Population Reference Bureau, Vol. 37, No. 3, August 1982.

Figure 47
Life Expectancy, 1960 and 1980



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the system faces other challenges: conflicting institutional goals, lack of preventive care, poor training, and technical bottlenecks. These are now being tackled, but whether successfully so remains to be seen. To keep hospital death statistics low, for example, a Western physician who has written a study on Soviet medicine reported that Soviet authorities have encouraged "hopeless" patients to check out and return home so that the hospital will not be investigated for exceeding its "death quota." At the same time, hospital stays are prolonged, providing employment for many through medical make-work, but this contributes to a higher incidence of hospital-induced infection. []

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A major difficulty is that the Soviet system has focused on curing illness rather than preventing it. Soviet statistical data show that diseases that are easily controlled in other countries run rampant in the Soviet Union. Influenza, for example, kills tens of thousands of Soviet babies annually, and rickets remains one of childhood's scourges. The United States no longer keeps statistics on rickets because it is so rare. The Soviet typhoid fever rate per 100,000 population in 1979 was about 30 times that in the United States, and the measles rate was over 20 times as high. Whereas 70 percent of cervical cancer cases in the United States are identified in their early, potentially treatable stages, 60 percent of Soviet cases are not recognized until they are terminal. []

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So far, the Soviet Union's economic plan has given low priority to developing and producing equipment that Western doctors associate with modern medicine. According to a published study by a US doctor, the USSR operates only a few dozen kidney machines, and its few hundred available pacemakers are imported. Disposable equipment—syringes, needles, tubing, and bedding—are in short supply. The low priority given to other consumer-oriented sectors results in additional shortages. When output goals in other sectors are not met, the supply to the medical sector of such nonmedical goods as automobiles, building materials, and textiles becomes erratic. Because of fuel shortages, for example, only 30 percent of the gas requirements for emergency vehicles are being met. []

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Confidential**Housing**

The shortage of housing in the Soviet Union is severe. An estimated 20 percent of city dwellers still share their living space with unrelated families or singles. Determining the magnitude of the shortage is difficult, however, because the Soviets do not publish statistics on the number of households. We have estimated the housing deficit by comparing the number of housing units constructed with the number of marriages. In 1982, marriages outnumbered housing units built by 766,000 (deaths would of course have reduced this total demand for new units). []

Seeking to control this demand, the regime has limited the creation of new households by refusing to put singles on lists for available housing. But at the same time it keeps rents down through large subsidies, spurring demand by making rents easily affordable. On the supply side, the primary reason the USSR has not built more houses is the inadequate priority given to their construction in investment decisions. In addition, the rising cost of new construction—reflecting an increase in the average size of new dwellings, the provision of more utilities, and the increased costs of materials—has limited the number of units built. []

Soviet per capita housing expenditures, which had been less than 20 percent of the US level in 1960, were as little as 10 percent in the early 1980s, as US growth rates in per capita expenditures for housing (3 to 4 percent a year) outstripped Soviet rates (1 to 2 percent a year). Not surprisingly, Soviet consumers have a much more limited choice. The government owns three-quarters of all urban housing (almost entirely apartments) and controls its construction and distribution. The wait for an apartment can be as long as 10 years, although the average is substantially less. Priority is often determined by a worker's position or the importance of his place of employment. In contrast to the United States, where the poorest housing is often concentrated in the core of urban areas, Soviet housing policy has scattered substandard housing throughout the cities, as well as in a band on the peripheries. []

Living quarters in the USSR are far less spacious than in the West. In the 1920s the Soviets set a national minimum standard for "health and decency" of 9 square meters of "living space" per urban person; this is equivalent to 13.5 square meters of "general space"—about the size of a room 12 feet by 12 feet. The Soviet Union as a whole has exceeded this by providing an average of 14 square meters of general space per capita in 1980. The 14 square meters compares with the US figure of 49 square meters of general space per capita. (figure 48). []

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Conditions are worse in rural areas. Most urban housing comes equipped with electricity, indoor plumbing, hot water, gas, and central heating; but in rural areas the typical privately owned one-story wooden home lacks indoor plumbing and central heating, although it now has electricity. According to published Soviet statistics for 1980, for example, only 38 percent of state-owned rural housing units in the Russian Republic were connected to central water supply systems and 22 percent to sewer lines; 26 percent had central heating. In both urban and rural areas, the quality of new construction in general is shoddy; for example, only roughly 40 percent of housing turned over for occupation in the Russian Republic each year is rated "satisfactory" or better.

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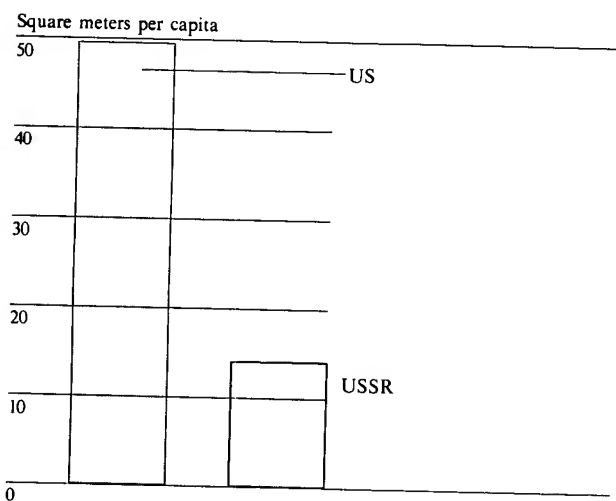
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Figure 48
Housing Space, 1980



Note: Housing space consists of living space (bedrooms and living rooms) plus hallways, kitchens, bathrooms, and closets.

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Confidential**Transportation**

The typical Soviet citizen depends much more heavily on common carriers than his American counterpart—in part because of the regime's greater emphasis on public transportation, but also because of the undeveloped nature of the Soviet auto industry, road system, and support services. In 1982, for example, the volume of *intercity* passenger traffic by common carriers was more than twice as large in the USSR as in the United States; 85 percent of all US intercity travel was by private automobile, even though the United States is trying to encourage greater use of common carriers. Soviet travelers used railroad transportation almost 20 times as much as US travelers did; air travel was the most used US form of common carrier intercity transportation (figure 49). The patterns are similar in *intracity* transportation: Soviet streetcars, trolleys, subways, and local buses carried more than six times as many passengers as US local systems.

slower. For example, there are not enough gas stations, spare parts, repair shops, or parking spaces in the Soviet Union to meet the burgeoning demand. By one estimate, there was one Soviet gas station for every 1,250 cars in the late 1970s, when there was one US station for every 430 cars. As might be expected under such circumstances, people turn to the black market. Selling gasoline from state-owned trucks is a widespread practice, even though the penalty is heavy. Many people turn to the black market to obtain spare parts or repair services, often at very high prices.



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The Soviet Union has entered the age of the automobile, but it will be a long time before driving a passenger car in the USSR approaches the ease and convenience taken for granted in the West. The Soviet inventory of cars in 1980 was roughly where the US inventory stood in 1920—and even this represented considerable progress (figure 50). Soviet auto production more than tripled between 1970 and 1975 as the Fiat-designed and Western-equipped Volga Motor Vehicle Plant came on line (figure 51). Growth in production slowed during the 10th Five-Year Plan (1976-80), as the Soviets shifted from large increases in production capacity to improvements in the manufacturing processes.

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The expansion in the inventory of private automobiles has brought with it many of the same problems that the United States experienced at a similar stage of development. The US market responded relatively quickly to those problems, however, whereas the less flexible, highly centralized Soviet system has been

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Figure 49
Passenger Travel Between Cities
by Common Carrier, 1982

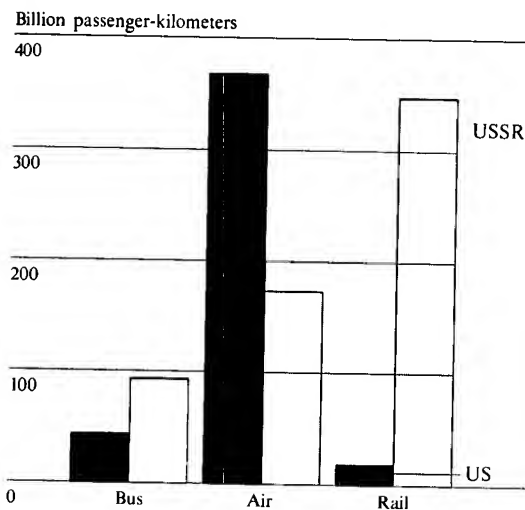


Figure 50
Private Ownership of Automobiles,
1960 and 1980

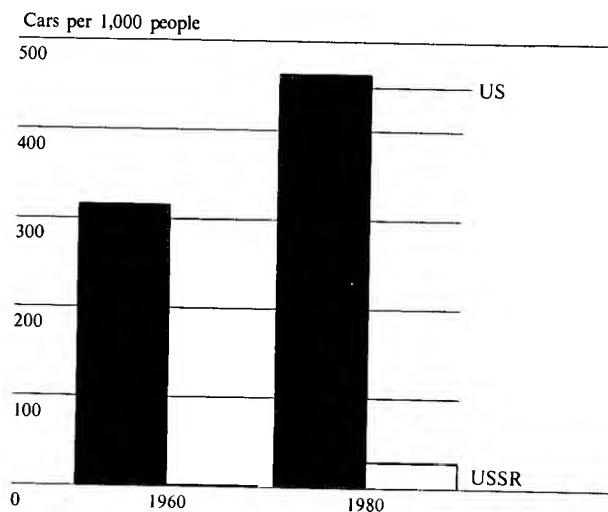
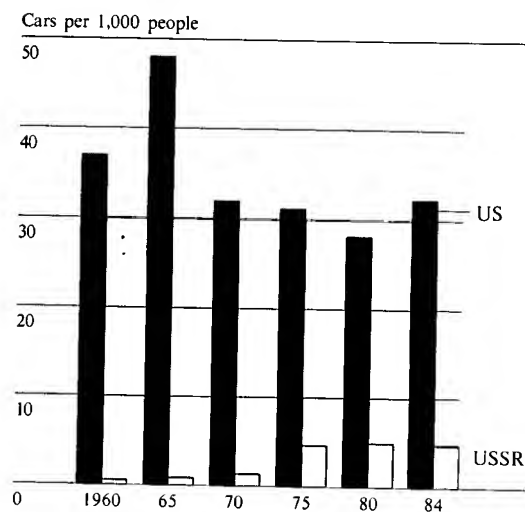


Figure 51
Production of Passenger Cars,
Selected Years



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Appendix A

Derivation and Significance of the Geometric Mean Measure in International Comparisons

A consistent comparison of two economies can be made when both national outputs are expressed in the monetary unit of one country or the other. The generally preferred procedure for making international economic comparisons is to convert each country's GNP into the currency of the other country (for example, to express the Soviet GNP in dollars and the US GNP in rubles). The two GNPs can then be compared in two different terms—rubles and dollars.

The two comparisons will yield different results. This phenomenon is commonly known as the index number problem, and it results from differences in the relative amounts and prices of goods and services found in each country. Goods produced in relatively large quantities in a country tend to sell at relatively low prices there, and scarce goods at higher prices. Investment and defense goods account for larger shares of output in the Soviet Union than in the United States—that is, they are more plentiful; therefore, the Soviet GNP is a larger percentage of US GNP when comparisons are made in dollars, since dollar prices place greater weight on investment and defense goods than ruble prices do.

The lack of a single quantifiable comparison can be presentationally awkward, so economists by convention often resort to the "geometric mean" as a basis for a single comparison. In the case of two countries, the geometric mean is the square root of the product of the two comparisons. However, the theoretical justification of the geometric mean as a valid *average* indicator in economic comparisons is disputed. Abraham Becker argues against its use in US and Soviet

comparisons because "the average reflects neither the dollar nor the ruble price pattern and in principle, therefore, is simply wrong."⁷ Paul Samuelson, on the other hand, believes that use of the geometric mean "does seem more evenhanded."⁸ This paper adopts the geometric mean convention, but the reader should remember that a geometric mean represents neither the ruble nor the dollar comparison. Soviet GNP in 1984 was 63 percent of US GNP when both are measured in 1976 dollars, and it was 43 percent of US GNP when both are measured in 1970 rubles; calculated with the geometric mean, it was 52 percent. If all of this sounds confusing, solace may be found in the words of the late Rush Greenslade:

The GNP ratios have a broad, general, far from precise meaning, one which tends to disappear if you try to pin it down. Like a faintly fragrant flower, it can be apprehended by gentle inhalations, but an attempt to extract the scented oil and subject it to chemical analysis will ruin it altogether.

⁷ "Comparisons of United States and USSR National Output: Some Rules of the Game," *World Politics*, vol. XVIII, No. 1, October 1960.

⁸ "Analytic Notes on International Real Income Measures," *Economic Journal*, September 1974, p. 608.

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Appendix B

Problems in Measuring Quality Differences

Measuring quality differences is a thorny problem in any international comparison, but it is particularly troublesome in a US-Soviet comparison because the two economies are in such dissimilar states of development. This appendix discusses how quality differences are handled in two important areas: consumption and machinery. []

Consumption

In quantitative expressions, the comparisons of US and Soviet consumption may be close to the mark, but as carriers of quantitative and qualitative notions about relative levels of living in the two countries they surely overstate the Soviet position. Several diverse considerations bear on this point. First, there is the question of accuracy of the product and price matchings of consumer goods and services in the sample. The greatest accuracy attaches to the samples of food and clothing products, and a lesser degree to services. To the maximum extent possible, the matchings allowed for differences in the qualitative aspects of the product by making appropriate adjustments in the price ratios. For goods, most of these adjustments were made by qualified US manufacturers and retailers. For services, they were largely analysts' judgments, based on a variety of relevant evidence. In the case of health and education services, where the comparison is based on inputs, they are assumed to be of equal quality in the two countries—on the principle that "a doctor is a doctor." The inferior training of Soviet medical personnel is thus ignored (emigre doctors must be radically retrained to practice medicine in the West). Also ignored is the presumably better quality of US health care (and perhaps education), which is associated with this country's having more capital per worker. []

On the less tangible aspects of quality, the bias of our quantitative comparisons is unmistakably in the USSR's favor. All observers, along with a strident Soviet press, agree that Soviet-manufactured goods are sadly deficient in style, design, and attractiveness,

when compared with Western models. The comparisons in this study could not take into account these important aspects of consumer satisfaction. Similarly, allowance could not be made for the notoriously poor quality of retail services in the USSR; only the added costs are reflected in product prices. The same point holds for other kinds of services; differences in the location where they are provided—an ingredient of usefulness—could not be captured in relative prices. The inferior quality of Soviet distribution and service facilities and of services per se is the direct legacy of the "second-class" status long accorded the service sector in the government's scheme of resource allocation. []

Another source of upward bias in the US-Soviet comparisons is the fact that the sample of goods and services necessarily reflects the Soviet mix much better than it does the US mix. Simplicity, standardization, and slowness to modernize design are hallmarks of the Soviet production pattern. Hence, matches often had to be made using a US item that—while roughly equivalent to the typical product purchased by Soviet consumers—is not representative of purchases in the United States. This problem affects consumer durables in particular. To illustrate: the price ratio for refrigerators is based on a comparison of the typical Soviet one-door, seven-cubic-foot unit with a small (nine-cubic-foot) US apartment-size unit that is not at all typical of the sales mix in the United States. For sewing machines, the typical Soviet model was judged to be a copy of a Singer model of the 1920s. The Soviet semiautomatic washing machine was matched with a US apartment-size model that could hardly find a market. []

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Still another source of bias is to be found in the monotony in color, style, and design that characterizes the Soviet mix; the variety factor differs among products, of course, but the difference must be at least fivefold in most relevant cases. A Soviet consumer has a limited choice, partly because the planners' choices rather than his own preferences determine the diversity of product mix, and partly because producers, in response to the incentives facing them, have consistently preferred quantity production of a few standardized items. For these reasons, also, the US-Soviet comparison is bedeviled by the problem of unique products—a stumbling block in any international comparison of an advanced country with one considerably less advanced. Numerous products—for example, dishwashers, toaster ovens, blue jeans, and air conditioners—that are common in US households could not be included in the sample, because the USSR either does not produce them at all or produces them in miniscule quantities.

Another nonquantifiable aspect of the comparison of consumption relates to the balance of supply and demand, both in the aggregate and for individual goods and services. The Soviet Government fixes the prices for consumer goods and boasts of the stability of the retail price level. Yet, overall excess demand in consumer markets is frequently in evidence, manifesting itself in a rising marginal propensity to save, much queueing, and black markets. More serious, however, are the pervasive disequilibriums in the supply and demand for individual goods and services. A mass of anecdotal evidence demonstrates this situation. Random shortages prevail—toothpaste today, soap powder tomorrow, film the next day, and on and on in infinite variety. Random surpluses accompany the shortages. Sewing machines pile up at retail stores in Moscow, but are not to be found in Frunze; unsalable surpluses of clothing and footwear appear periodically, and the goods must be heavily discounted in price or scrapped. Consumers spend inordinate amounts of time standing in line or trudging from store to store in search of desired items. These perennial features of the consumer milieu in the USSR cannot be captured in any international comparison of prices and quantities, but they are important aspects of utility.

Machinery

Similar problems affect the machinery comparisons. For historical reasons, however, they are handled differently. Unlike consumer items, Soviet and US machinery items were matched on the basis of function and performance. In this type of matching, US counterparts need not resemble the Soviet items in physical design or characteristics. The crucial criteria are that the US items perform the same function(s) as the Soviet items and approximate as closely as possible the Soviet level of performance. For example, in matching a US truck to a Soviet model, the US truck not only must be of the same type (perform the same function) but also must have about the same load capacity and power (have the same level of performance). If more than one US analog matched the Soviet item to the same degree, the cheapest one was selected.

In matching Soviet machinery items, US analogs were not adjusted for differences in performance specifications and quality. Both deficiencies in data and complexities in methodology stand in the way of normalizing the ratios for these differences. The problem is a serious one, since these differences may not be offsetting and could lead to a cumulative bias in the results. In general, the Soviet items in the machinery sample tend to be technically inferior (do not match the capabilities of US counterparts) and of lower quality (less durability)—all tending toward the overstatement of the value of the ruble with respect to the dollar. Almost certainly, adjustment of prices to take account of all differences in performance and quality would lower dollar values (or raise ruble values), and thus raise the value of the ratios.

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